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THE STATISTICAL LAW OF DEMAND AS ILLUSTRATED BY THE DEMAND FOR SUGAR

PART II. THE DERIVATION OF THE LAW OF DEMAND FOR SUGAR

VI. THE METHOD OF LINK RELATIVES APPLIED TO THE UNADJUSTED DATA

In Table I of Appendix II there are recorded, for the period from 1890 to 1914 inclusive, two unadjusted series: the total yearly consumption of sugar in the United States, and the average annual wholesale prices at New York of refined sugar in cents per pound.[1] The New York prices are taken because New York was the dominant sugar market during the period covered by this investigation; prices in all markets throughout the United States were fixed by the New York price. In the same table there are also recorded the link relatives of consumption and of prices (columns 4 and 5).

There is no correlation between the crude data for con-

[1] The statistics were derived from Truman G. Palmer's loose-leaf service, *Concerning Sugar*, pp. E-54, *A*, *B*, *C* (consumption), and p. E-8 (prices).

sumption and prices[2] (columns 2 and 3). On the other hand, there is considerable correlation between the link relatives of total consumption (X) and the link relatives of money prices (Y), the coefficient of correlation[3] being -0.68 ± 0.07. A

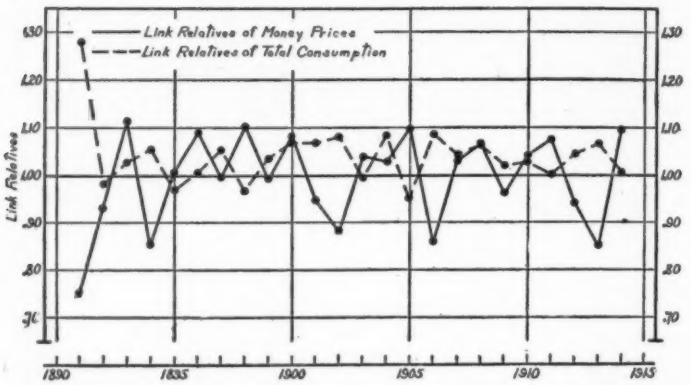

FIG. 4.—Inverse correlation between the link relatives of the total consumption of sugar in the United States and the link relatives of the wholesale money prices of sugar.

graphic presentation of this inverse relationship is to be found in Figure 4.

I. THE PROBLEM OF FITTING THE DEMAND CURVE

When the link relatives are plotted on a scatter diagram (see Fig. 5), the nature of the correlation between the two variables is more clearly exhibited. It will be seen that, considering the number of observations and their distribution, one would hardly be justified in assuming skew relationship. Hence the problem of deriving the law of demand for sugar reduces to the problem of deriving the equation of the "best-fitting" straight line.

The common method of fitting a straight line to data in-

[3] $r = -0.06 \pm 0.14$.

[2] The means of the link relatives of consumption and the link relatives of prices are 1.0415 and 0.9936 respectively. The standard deviations are 0.062,925 and 0.096,696, respectively.

volves the arbitrary selection of one of the variables as the independent variable X and the assumption that an observed point fails to fall on the line because of an "error" or deviation

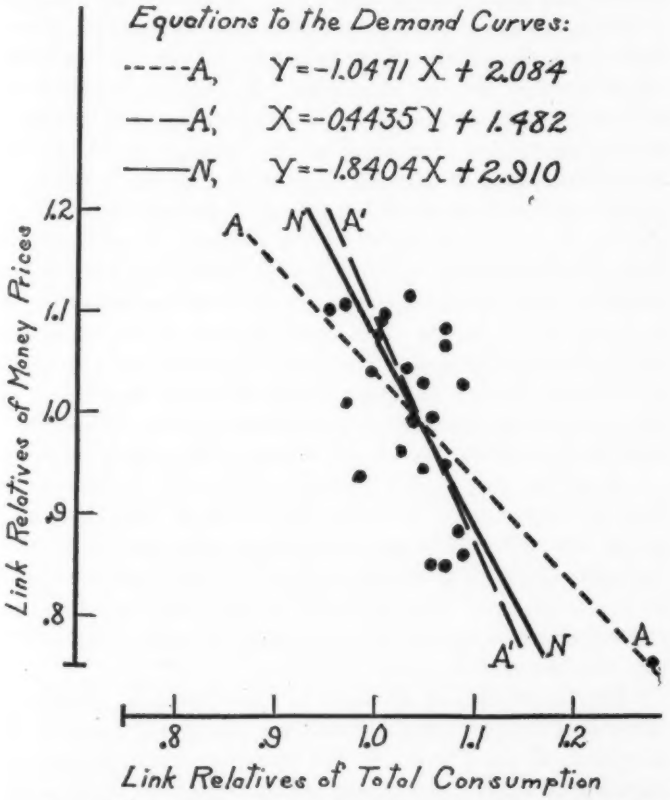

FIG. 5.—Scatter diagram of the link relatives of the total consumption of sugar and the corresponding link relatives of the wholesale money prices of sugar, with the lines of regression (A and A') and the "line of best fit" (N).

in the dependent variable Y alone, the X variable being allowed no deviation. The result of this method is that we get one straight line if we treat one of the variables as the independent variable, and a quite different one if we treat the other variable

as the independent variable. Thus, in Figure 5, the straight line A (the regression of Y on X) gives the most probable relative change in the price of sugar (Y) corresponding to a given relative change in consumption (X). The assumption made in deriving this line is that the statistics of consumption are free from error, the failure of the points to fall on the line being due to errors in the price data only. The line A' (the regression of X on Y) gives the most probable relative change in consumption corresponding to a given relative change in price. The assumption made in deriving this line is that the statistics of prices are free from error, the failure of the points to fall on the line being due to errors in the statistics of consumption alone. In deriving line A the sum of the squares of the *vertical* distances of the points from the line was made a minimum. In deriving line A', on the other hand, the sum of the squares of the *horizontal* distances of the points from the line was made a minimum. *In fact, in fitting line A the observed values in X are regarded as having a weight infinitely greater than those in Y, while in fitting line A′ the reverse assumption is made.*

It will be seen from Figure 5 that there is a considerable difference between the *slopes* of the two lines. That is to say, we get two quite different demand curves from the same equation according as X (consumption) or Y (prices) is assumed to be free from error. The difference is sometimes such that one curve shows that the demand is elastic, while the other shows that the demand is inelastic.

Now in practically all cases of observed data relating to demand and supply, the X variable is as subject to errors or deviations as the Y variable. We know, for example, that the statistics of sugar consumption are as subject to error as the statistics of sugar prices, if not more so. It therefore appears that a better-fitting straight line will be obtained by assuming that an observed point fails to fall on the line because there is an error in both X and Y. The curve-fitting method which is based on this assumption is much more complicated than the ordinary method. To the best of our knowledge, its *direct* application has thus far been confined to the simplest of all

curves—the straight line. Indeed, if the method is to be applied by direct processes the further assumption has to be made that the errors of X and Y have a constant ratio. When this ratio is equated to unity, that is to say, *when the observations in X are given the same weight as those in Y,* or when the two variables are assumed to be equally accurate or equally inaccurate, this method has a simple geometrical interpretation: it makes the sum of the squares of the *normals*—the perpendicular distances of the points from the curve—a minimum.[4] The line N (Fig. 5) was fitted on this assumption. It may, therefore, be looked upon as the "line of best fit." Within the

[4] The hypothesis that the independent variable is as subject to error as the dependent variable has been considered by Kummell (1879) (*a*), Merriman (1891) (*b*), Pearson (1901) (*c*), Reed (1921) (*d*), Gini (1921) (*e*), and Pietra (1924) (*f*).

a) Charles H. Kummell, "Reduction of Observation Equations Which Contain More Than One Observed Quantity," *Analyst,* Vol. VI, No. 4 (July, 1879).

b) Mansfield Merriman, "The Determination, by the Method of Least Squares, of the Relation between Two Variables, Connected by the Equation $Y=AX+B$, Both Variables Being Liable to Errors of Observation," *Report U.S. Coast and Geodetic Survey,* 1890, p. 687.

Cf. also *A Text-Book on the Method of Least Squares* (1910), p. 127, by the same author.

c) Karl Pearson, "On Lines and Planes of Closest Fit to Systems of Points in Space," *Philosophical Magazine,* 6th Series, Vol. II (November, 1901).

d) L. F. Reed, "Fitting Straight Lines," *Metron,* Vol. I (1921), No. 3 (I–IV).

e) Corrado Gini, "Sull'interpolazione di una retta quando i valori della variabile indipendente sono effetti da errori accidentali," *ibid.*

Cf. also Corrado Gini "Considerazioni sull'interpolazione e la perequazione delle serie statistiche," *ibid.*

f) Gaetano Pietra, "Interpolating Plane Curves," ibid., Vol. III (1924), No. 3–4 (I–II).

(No claim is made that this is an exhaustive list.) With the exception of Pearson, who applies this hypothesis to the fitting of the plane as well as of the straight line, all of these writers confine their treatment to the straight line, although Pietra promises also to determine the parameters of the ordinary parabola by this method in a forthcoming paper. Pearson and Reed make the tacit assumption that the precisions or the weights of X and Y are *equal.* In this respect their treatment is less general than that of the other writers, who assume only that the precisions of X and Y have a *constant ratio.* Pearson's and Reed's results are thus special cases of the more general conclusions.

It does not appear that the researches of Kummell and Merriman are known to the later writers.

limits of observation, it is the best "demand curve" that may be derived from the data at hand. It gives the most probable relation between relative consumption changes and relative price changes for the interval 1890–1914.

2. THE LAW OF DEMAND IN TERMS OF LINK RELATIVES

The equation of line N is

$$Y=-1.8404\,X+2.910 \qquad (4)$$

the origin being at 0,0. This means that, based upon the experience from 1890 to 1914, an increase (or decrease) of one *point* (or, roughly, 1 per cent) in the link relative of consumption, is *on the average*, associated with a decrease (or increase) of 1.84 *points* in the relative price. Another way of saying the same thing is that an increase (or decrease) of one *point* in the relative price is, *on the average*, associated with a decrease (or increase) of $1/1.8404=0.54$ of a *point* in the relative consumption. If line A be taken as the demand curve, the corresponding figure is $1/1.0471=0.96$ of a *point*, and if line A' be taken as the demand curve, it is 0.44 of a *point*.

By means of this equation it is possible to estimate the probable change in the price corresponding to a given change in consumption, or the probable change in consumption corresponding to a given change in price. In 1913 the consumption of sugar in the United States was 4,192,000 short tons. (See Table I of Appendix II.) In 1914 the consumption was 4,212,000 tons. What was the probable price of sugar in 1914? The change in consumption as measured by the link relative was $4{,}212{,}000\div 4{,}192{,}000=1.005$. Substituting this value for X in the equation $Y=-1.8404\,X+2.910$ and solving for Y, we find that the probable price would be 1.0604 of the price for the preceding year. Since the price for 1913 was 4.278 cents, this value of Y would give 4.536 cents as the probable price for 1914. The actual price was 4.683 cents. In like manner we can estimate the probable change in consumption corresponding to a given change in price.[5]

[5] This example illustrates the type of problem which arises most frequently in practical forecasting, namely, having estimated or observed the value of one

3. THE LAW OF DEMAND IN TERMS OF ABSOLUTE QUANTITIES

Equation (4) gives the most probable relation which existed between the relative changes in the consumption and the corresponding relative changes in the price of sugar during the interval 1890–1914. It is the law of demand for sugar in the link-relative form. A simple transformation, however, makes it possible to take the next step—the derivation of the law of demand for any one year in terms of absolute quantities. By definition, $X=\frac{x}{x_0}$ and $Y=\frac{y}{y_0}$, where x_0 and y_0 are respectively the consumption and prices in the preceding or base year. By making these substitutions in (4), the law of demand in the absolute form becomes

$$y/y_0=-1.8404\,x/x_0+2.910$$

$$\text{or } y=-1.8404(y_0/x_0)x+2.910y_0 \qquad (5)$$

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variable, to find the probable value of the other. In the solution of this problem the given value is assumed to be free from errors of observation and the "line of best fit" is used like an ordinary line of regression. The solution would be different, however, if we were given the observed values of *both* variables for any one year and were required to compute the corresponding probable values, since errors in both variables would then have to be taken into account.

Thus, if the equation to the "line of best fit" be $Y=AX+B$, then the probable or adjusted pair of values X_1' and Y_1' corresponding to the given or observed pair X_1 and Y_1 would have to be obtained from the following relationships:

$$X_1'=X_1-\frac{A}{G+A^2}(AX_1+B-Y_1)$$

$$Y_1'=Y_1+\frac{G}{G+A^2}(AX_1+B-Y_1)$$

where G is the ratio of weight of the independent variable to that of the dependent variable. (See reference *b* on p. 581.) In deriving equation (4) as well as all the other "lines of best fit" used in this study, G was taken as unity.

If in the above equations we substitute for X_1 and Y_1 their observed values for 1914 (see Table I of Appendix II) by putting $X_1=1.005$ and $Y_1=1.095$, we obtain as the most probable values for that year $X_1'=0.9905$ and $Y_1'=1.0871$. The latter are the co-ordinates of the point at which the normal through the observed point crosses line N (Fig. 5).

which may also be written[6] as

$$x = -0.5433\,(x_0/y_0)y + 1.581\,x_0\,. \qquad (5a)$$

If, for example, it is desired to have the law of demand for sugar in 1914, all that we have to do is to find the observed consumption (x_0) and the observed price (y_0) for the "previous year," or 1913, and to substitute these values in either (5) or (5*a*). The observed consumption and price for each year between 1890 and 1914 are shown in Table I of Appendix II. It will be seen that in 1913 the consumption of sugar amounted to 4,192,000 tons (x_0), and the price was 4.278 cents (y_0). Substituting these values in (5) we obtain

$$y = -0.000{,}001{,}878\,x + 12.449\,.$$

This form is very convenient for estimating price from consumption. Thus, the total consumption of sugar in 1914 amounted to 4,212,000 tons. What was the probable price? Substituting this value of x in the foregoing equation we obtain $y = 4.539$, or the probable price for 1914 would be 4.539 cents. The observed price was 4.683 cents—a difference of 3 per cent.

If, on the other hand, it were desired to estimate consumption from price, it would be more convenient to substitute x_0 and y_0 in equation (5*a*), which, for 1914, becomes

$$x = -532{,}000\,y + 6{,}628{,}000\,.$$

By way of comparison it is interesting to have the corresponding equations for 1904 and 1894. These are

$$x = -335{,}000\,y + 4{,}515{,}000$$

$$\text{and } x = -240{,}000\,y + 3{,}377{,}000\,.$$

That is to say, a rise or fall in the price of sugar of one cent per pound would have decreased or increased consumption by 240,000 tons in 1894, by 336,000 tons in 1904, and by 532,000 tons in 1914. Corresponding equations may be derived for all the other years between 1890 and 1914. *Such equations afford*

[6] It must be kept in mind that equation (5*a*) is not the "regression of x on y" in the sense in which this expression is used in statistical literature. It is simply another form of (5).

a measure of the shifting of the demand curve from year to year as a result of dynamic changes. In a subsequent section, however, a more satisfactory method of determining these equations will be presented.

4. THE STANDARD ERROR OF THE DEMAND CURVE

It is desirable to have a measure of the accuracy or "goodness of fit" of line N and to compare it with that of line A and line A'. The constant that is most commonly used to measure the "goodness of fit" of a curve is the standard error, or the root-mean-square deviation of the actual observations about the fitted curve. The standard error enables us to tell the *degree* of scatter, or the limits within which any proportion of the observations (points) are distributed about the line or curve under consideration. Assuming that the points are symmetrically distributed about the line or curve, we know from the Table of the Probability Integral that 68 per cent of all observations fall within $\pm$ the standard error; 95 per cent between $\pm$ twice the standard error; and 99.7 per cent between $\pm$ three times the standard error. All other things—the number of constants in the equations, the nature of the underlying assumptions, etc—being the same, the "goodness of fit" of a curve is inversely proportional to its standard error. That curve gives the best fit which has the smallest standard error.

In the case of the three lines of Figure 5, however, we should not be justified in comparing standard errors for the purpose of selecting the line of best fit, because the standard errors of these lines are not really comparable. The errors in question are: $S_A=0.0708$, $S_{A'}=0.0461$, $S_N=0.0413$, where S_A, $S_{A'}$, and S_N denote the standard errors of the lines A, A' and N respectively.[7] That is to say, 68 per cent or, say, two-thirds

[7] These errors were computed from the following formulas:

$$S_A=\sigma_Y(1-r^2)^{\frac{1}{2}}$$

$$S_{A'}=\sigma_X(1-r^2)^{\frac{1}{2}}$$

$$S_N=\left[\tfrac{1}{2}(\sigma_X^2+\sigma_Y^2)-\tfrac{1}{2}\sqrt{(\sigma_X^2+\sigma_Y^2)^2+4r^2\sigma_X^2\sigma_Y^2}\right]^{\frac{1}{2}}$$

where σ_Y is the standard deviation of the variable Y, σ_X is the standard deviation of the variable X, and r is the coefficient of correlation between the variables. The first two formulas are well known. The third is given by Pearson, *loc. cit.*

of all the points or observations lie within a distance of $\pm$ 0.0708 units from line A, of $\pm$ 0.0461 units from line A', and of only $\pm$0.0413 units from line N. *But these distances are not measured in the same direction.* Thus, S_A represents a *vertical* distance of $\pm$0.0708 units from line A (the regression of Y on X), $S_{A'}$ represents a *horizontal* distance of $\pm$0.0461 units from line A' (the regression of X on Y), while S_N represents a *perpendicular* distance of $\pm$0.0413 units from line N. In other words, the standard errors are measured in *different units*. Thus S_A is measured in terms of Y (*prices*), $S_{A'}$ in terms of X (consumption), and S_N in terms of both X and Y.[8] These errors are, therefore, not comparable.

To obtain comparable standard errors, the deviations about each of the three lines should be measured *in the same direction.* That is to say, the three sets of deviations should all be measured either in the vertical direction, or in the horizontal direction, or in the direction normal to the line under consideration. But if we do this, we shall get different results, depending upon the direction selected. Thus, if the deviations about the three lines be measured in the vertical direction, we know that line A will have the smallest standard error, for it was fitted by making the sum of the squares of the vertical deviations a minimum. If

[8] This follows from the fundamental assumption made in fitting line N, namely, that an observed point fails to fall on the line because of *two* errors or deviations: a (vertical) deviation in the dependent variable Y, and a (horizontal) deviation in the independent variable X. The normal deviation is simply the resultant of these two deviations, the three quantities being related in the same way as the hypotenuse and the two sides of a right triangle.

Let X_1 and Y_1, and X_2 and Y_2, etc., be the co-ordinates of the observed points. Let X_1' and Y_1', X_2' and Y_2', etc., be the co-ordinates of the corresponding adjusted points, i.e., the points at which the normals intersect the "line of best fit." Let W be the number of points or of pairs of observations. The vertical deviations are Y_1-Y_1', Y_2-Y_2', etc. The corresponding horizontal deviations are X_1-X_1', X_2-X_2', etc. Hence the sum of the squares of the normal deviations may be written as

$$WS_N=\Sigma(X-X')^2+\Sigma(Y-Y')^2 .$$

It is this function which was made a minimum in the fitting of line N.

the deviations about the three lines be measured in the horizontal direction, we know that line A' will have the smallest standard error, for it was fitted by making the sum of the squares of the horizontal distances a minimum. If the deviations about the three lines be measured in directions perpendicular to these lines, we know that line N will have the smallest standard error, for it was fitted by making the sum of the squares of the normal deviations a minimum.

We conclude, therefore, that while the standard error of line N ($S_N = 0.0413$) has a perfectly definite meaning, it cannot be compared with the standard errors of line A and line A'. The three lines are the result of three different assumptions regarding the distribution of errors in X and Y. The justification of selecting line N as "the line of best fit" must, therefore, be based on the fundamental considerations which were adduced, and not on the size of its standard error.

5. THE COEFFICIENT OF THE ELASTICITY OF DEMAND

Having determined the law of demand for sugar as well as its standard error, and having indicated the great care that must be exercised in comparing standard errors, we are in a position to compute the coefficient of the elasticity of demand.

It will be recalled that by definition the coefficient of the elasticity of demand is

$$\eta = \frac{dx}{x} \Big/ \frac{dy}{y} = \frac{dx}{dy} \cdot \frac{y}{x}.$$

As the law of demand for any one year is, as we have seen, given by (5), all that we have to do in order to derive the coefficient of the elasticity of demand for any one year is to find $\frac{dx}{dy}$ from (5) and to multiply the result by y/x. We have

$$\frac{dx}{dy} = 1 \div \frac{dy}{dx} = -\frac{1}{1.8404} \cdot \frac{x_0}{y_0} = -0.5433 \frac{x_0}{y_0}$$

$$\therefore \eta = \frac{dx}{dy} \cdot \frac{y}{x} = -0.5433 \frac{y}{y_0} \cdot \frac{x}{x_0}. \qquad (6)$$

But $\frac{y}{y_0}=Y$ and $\frac{x_0}{x}=\frac{1}{X}$. Hence (6) may be written as

$$\eta=-0.5433\ Y/X \tag{6a}$$

This result, however, might have been obtained directly from (4) by finding

$$\frac{dX}{dY}\cdot\frac{Y}{X}=\eta=-0.5433\ Y/X$$

From (6a) we see that the coefficient of the elasticity of demand varies from point to point on the demand curve N (Fig. 5). It is higher for high prices (or low consumption) than it is for low prices (or high consumption). Its satisfactory representation, therefore, calls for a graph which would depict it as a continuous function either of consumption or of price. Such a graph will be presented later in connection with a more satisfactory method of deriving the demand curve for sugar. For the time being we shall content ourselves with determining the coefficient at only three points on the demand curve (4).

When $X=1$, that is to say, when there is no change in the consumption of sugar between any two consecutive years, then $\eta=-0.5433\ (1.0696)=-0.58$, or a reduction in the price of sugar of 1 per cent will increase consumption by 0.58 of 1 per cent. When $X=1.1$, that is to say, when "this year's" consumption is already 10 per cent above that for last year, then $\eta=-0.5433\ (0.8856/1.1)=-0.44$, or a reduction of 1 per cent in price will then increase consumption by only 0.44 of 1 per cent. On the other hand, when $X=0.9$, that is to say, when "this year's" consumption is only 90 per cent of that for the preceding year, then $\eta=-0.5433\ (1.2436/0.90)=-0.76$, or a decrease in the price of 1 per cent will, under those conditions, increase consumption by as much as 0.76 of 1 per cent. Had we chosen line A or line A' for our demand curve, we should have obtained considerably different values for our coefficients. It is evident, therefore, that the methods of fitting the demand curve have a great influence on the value of the coefficient of elasticity of demand.

VII. THE METHOD OF TREND RATIOS APPLIED TO THE UNADJUSTED DATA

In the preceding pages we have derived the law of demand for sugar from unadjusted data by the method of link relatives. We have made one *general* correction for all the disturbing factors affecting price and another *general* correction for all the disturbing factors affecting consumption by correlating the link relatives of the two variables rather than their absolute magnitudes. But, as we have pointed out in Part I, there is another method which may be used for making these general corrections —the method of trend ratios. What problems does this method raise which have not already been considered? Does it yield more satisfactory results than those which have just been obtained? We are now ready to address ourselves to these questions.

The method of trend ratios, it will be recalled, derives the demand curve, not from absolute prices and corresponding absolute quantities, but from the *ratios* of these variables to their respective trends (or "normal" values). The *rationale* of this method has already been explained[9] and, therefore, need not be repeated here. Suffice it to say that this method postulates a knowledge of the "normal" consumption and the "normal" price for each year, the assumption being that the "normal" values are slowly, smoothly changing quantities about which the observed quantities fluctuate. And as we have no a priori knowledge of what constitutes a "normal" consumption or a "normal" price for any single date, these norms must be obtained by fitting good empirical curves to the data before us.[10]

I. THE PROBLEM OF SELECTING A GOOD TREND

Now in the derivation of a good empirical trend, the statistician is faced with a fundamental difficulty: he must choose a curve which reproduces the underlying movement of the data without bending or twisting itself so as to conform to the ex-

[9] Cf. *Journal of Political Economy*, XXXIII (October, 1925), 503–4.

[10] Sometimes it is also advisable to have recourse to the graphic method and to the method of moving averages.

treme sinuosities, and which at the same time gives a good "fit" as judged by some arbitrary criterion—say, the mean square error. These requirements, however, are mutually destructive, and the statistician must exercise his judgment, in view of all the known facts, in effecting a happy compromise between these requirements. The whole question has been well stated by E. C. Rhodes:

> Given a series of points which require to be smoothed, we have always before us two principles, (1) that we must obtain a curve without the sinuosities which are not inherent in the data, and (2) we must get a curve which "fits" by least squares. These two principles are mutually inconsistent. On the one hand we can obtain the curve which actually goes through the points—here the sum of the squares of the errors is zero, but the curve is composed of perturbations or sinuosities. On the other hand we can obtain a perfectly smooth curve, a straight line, a parabola, a sine curve, or whatever may be chosen to suit the given series, and we obtain a large mean square error.
>
> Somehow by careful balancing of these two mutually destructive principles we can obtain for any data a curve which is *reasonably* smooth and which at the same time gives a series of errors which have a *reasonably* small mean square error. The smoothness we obtain is not the best, nor is the sum of the squares of the errors a minimum.[11]

In the case of most statistical series, it is impossible to get an objective test of the wisdom of one's compromise between smoothness and goodness of fit. With the data before us, however, we may get at least a rough check on the suitability of the "compromise curve" for the problem in hand.[12] The main, if not the only, object in fitting trends to consumption and prices is to enable us to remove the disturbing factors which affect these variables and mask or hide their true relationship; for we know that when all of the disturbing factors have been eliminated, the correlation between the variables is perfect. Hence those trends are most suitable which best accomplish this object. That is to say, of all the pairs of trends that may be obtained by selecting one trend for consumption and one for prices, that pair

[11] *Tracts for Computers, No. VI*, "Smoothing," pp. 43–44 (Cambridge University Press, 1921).

[12] See *Journal of Political Economy*, XXXIII (October, 1925), 503–4.

should be selected whose deviations (trend ratios), other things being equal, are most highly correlated.[13] If the curves which are indicated by this test are the same, or nearly the same, as those which would have been selected anyway on account of their appearing to be the best compromise between smoothness and goodness of fit, the confidence which statisticians are wont to place in the latter type of curve is not misplaced.

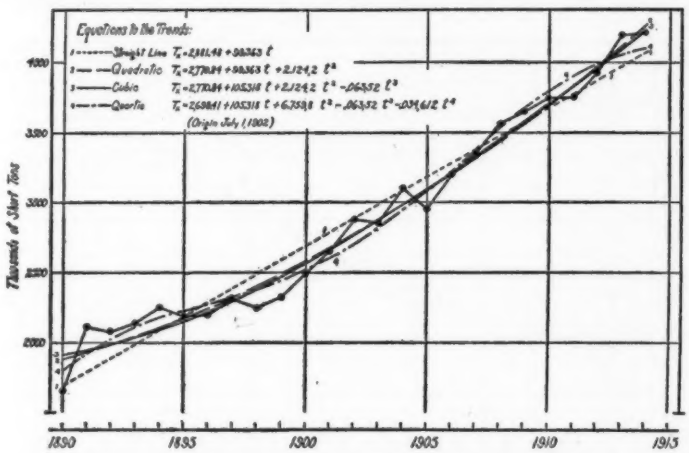

FIG. 6.—Total consumption of sugar in the United States, 1890–1914, and four fitted trends.

In Figure 6 there are graphed, for the period from 1890 to 1914, inclusive, the consumption of sugar in the United States, and four computed trends[14]—a straight line, a quadratic, a cubic, and a quartic (biquadratic). It is clear from the graphs that neither the straight line nor the quartic is a satisfactory trend. The former is not "flexible" or "sensitive" enough; the latter is too flexible to yield satisfactory estimates of "normal" consumption. The parabola and the cubic, on the other hand,

[13] Assuming of course, that due precautions are taken against spurious correlation.

[14] In the equations to the trends, x = actual or observed consumption; T_x = computed consumption; t = time in years, the origin being at July 1, 1902.

give excellent trends, and they are so nearly alike that it is impossible to tell which is the better of the two. As a choice has to be made, we take the cubic as giving the "best" trend of consumption. It is shown separately in Figure 7.

In Figure 8 are graphed the prices and six computed trends[15] —a straight line, a quadratic, a cubic, a quartic, a quintic, and a curve derived by Rhodes' method of smoothing[16] and designated by the letter *R*. The latter consists of arcs of high-order parab-

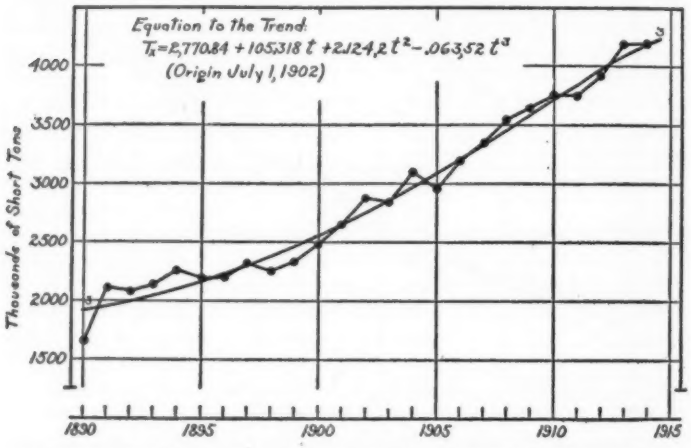

FIG. 7.—The "best" trend of the consumption of sugar in the United States, 1890–1914.

olas, each of which runs into its neighbors and has a contact of the first order only. Rhodes provides a rough method of deciding the number of points that should be employed in smoothing by his method. This test suggests a fifteen-point smoothing. A fourth-order parabola was fitted to the first fifteen points (i.e., to the prices from 1890 to 1904, inclusive) by the method of least squares, and the arc of this quartic between 1897 and 1898 was used as part of the final smoothed curve *R*. That is to say,

[15] In the equations to the trends, y = actual or observed price; T_y = computed price; t = time in years, the origin being at July 1, 1902.

[16] E. C. Rhodes, *op. cit.*

this first quartic fixed the smoothed or "normal" prices for 1897 and 1898. A parabola of the same order was then fitted to the next fifteen points (i.e., to the prices from 1891 to 1905, inclusive) in such a way that it joined on to the arc of the first curve at the smoothed ordinate for 1898 and had the same tangent at this point as had the first curve. The arc of this (second) curve between 1898 and 1899 was then used as part of our final curve. Proceeding in this way we derived the *R* curve between 1897

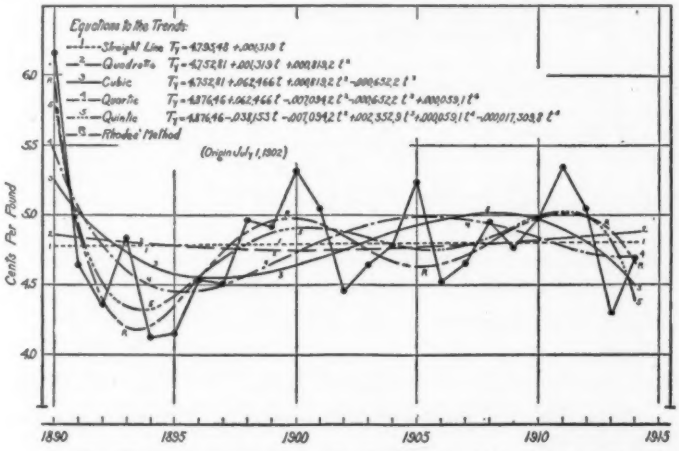

FIG. 8.—Wholesale money prices of refined sugar at New York, 1890–1914, and six fitted trends.

and 1908. The *tails* of the curve (i.e., the segment from 1890 to 1897 and the segment from 1909 to 1914) were obtained by using more of the first quartic that was found than its middle arc, and more of the last quartic that was found than its middle arc.

It is clear from Figure 8 that the straight line and the second-degree parabola are thoroughly unsatisfactory as trends. They are too "rigid" or "inflexible" and cannot, therefore, conform to the underlying movement of the observed data. The Rhodes curve and the quintic—especially the former—are, on the other hand, too "flexible" or "sensitive"; their fit is "too

good." Most statisticians, we dare say, would, by inspection, choose either the cubic or the quartic as being a happy compromise between smoothness and goodness of fit, the chances being slightly in favor of the cubic, as it is the simpler of the two curves. Of course, if the selection were to be guided by no other consideration than that of "goodness of fit," the palm would have to be awarded to the Rhodes curve.[17] The degree to which

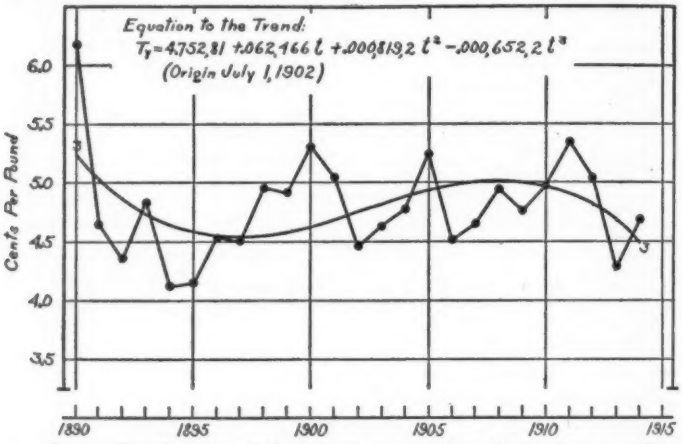

FIG. 9.—The "best" trend of wholesale money prices of refined sugar at New York, 1890–1914.

the cubic provides a satisfactory description of the underlying movement of sugar prices from 1890 to 1914 is best shown by Figure 9.

We are now ready to apply our test; that is to say, we are ready to determine which set of trend ratios is most highly correlated. Now the full application of this test would require the computation of twenty-four correlation coefficients[18]—by no

[17] The sum of the squares of the residuals of each of the six curves is shown in the following table:

Curve	Σv^2	Curve	Σv^2
Straight line	4.681	Quartic	3.149
Quadratic	4.630	Quintic	1.939
Cubic	3.681	Rhodes curve	1.890

[18] We fitted four curves to consumption and six curves to prices. As each curve yields a series of trend ratios, there are $4 \times 6 = 24$ possible combinations between the series of consumption ratios (X) and the series of price ratios (Y).

means an easy task. We shall, however, effect a great saving of time if we limit our computations only to those series which appear, by inspection, to yield promising results. A comparison of the curves in Figure 6 with those in Figure 8 suggests that no useful purpose will be served by including in our computations the series of ratios derived from curves 1, 2, and 4 of Figure 6,

TABLE IV

SUMMARY OF THE CORRELATION BETWEEN THE TREND RATIOS OF THE TOTAL CONSUMPTION OF SUGAR (X) AND THE CORRESPONDING TREND RATIOS OF SUGAR PRICES (Y)*

Constants	Correlation between X_3 and			
	Y_3	Y_4	Y_5	Y_8
Coefficient of correlation	-0.78 ± 0.053	-0.71 ± 0.067	-0.50 ± 0.102	-0.31 ± 0.122
Coefficient of elasticity of demand derived from:†				
a) Regression of Y on X	-0.745	-0.888	-1.571	-2.494
b) Regression of X on Y	-0.451	-0.446	-0.386	-0.242
c) "Line of best fit"	-0.506	-0.530	-0.613	-0.474

* X denotes the ratio of the observed consumption to the trend of consumption, and Y denotes the ratio of the observed prices to the trend of prices. The subscripts denote the curve which was used as the trend. Thus, X_3 means that in computing the series of consumption ratios curve 3 (Fig. 6) was used, etc.

† The coefficients of elasticity relate to the point $X=1$, $Y=1$.

and from curves 1 and 2 of Figure 8. The exclusion of these curves leaves only five series of ratios to be considered—one series of consumption ratios and four series of price ratios—and only four coefficients to be computed. The results of the computations are presented in Table IV.

From this table three conclusions may be drawn:

1) The use of comparatively simple curves for the purpose of obtaining "normal" consumption and "normal" prices yields better (a priori) results than those obtained through the use of more complex curves. The highest correlation ($r=-0.78$) between the trend ratios is obtained when a cubic is taken as the trend of prices as well as of consumption. The degree of corre-

lation diminishes as the complexity or sensitiveness of the price trend is increased until, as in the case when the Rhodes curve is used, the very existence of a correlation becomes somewhat doubtful.

2) The lower the correlation between X and Y, the greater the divergence between the coefficients of elasticity derived from the ordinary lines of regression. The common practice of arbitrarily selecting one of the variables as the independent variable, without considering the effect of the selection on the elasticity of demand, is apt to lead to erroneous conclusions.

3) Even if we choose the *worst* trends, thereby obtaining a low correlation between the resulting series of trend ratios (see column 5), recourse to the "line of best fit" still yields a fair approximation to the best value of the coefficient of elasticity of demand. (Compare column Y_R with column Y_3.) In fact, the lower the correlation between the variables, the more necessary it is to use the line or curve which makes the sum of the squares of the normals a minimum.

2. THE PROBLEM OF SELECTING A GOOD DEMAND CURVE

Having thus determined the trends of consumption and prices which are most satisfactory for our purposes, we are in a position to consider somewhat more fully than we have had occasion to do heretofore the further steps in the statistical determination of the law of demand by the method of trend ratios.

In Table II of Appendix II there are recorded, for the period from 1890 to 1914, the observed consumption and the observed prices of sugar; the "normal" consumption and the "normal" prices as determined from the most satisfactory trends; and the consumption ratios (X) and the price ratios (Y). The consumption ratios and price ratios are highly correlated, the coefficient of correlation being, as we have already pointed out, -0.78. A graphic presentation of this inverse relationship is to be found in Figure 10.

In Figure 11 the ratios are plotted on a scatter diagram. This diagram is a graphic representation of the observed relation between consumption ratios and price ratios during the pe-

riod from 1890 to 1914. Our problem now is how best to adjust these observations in order to derive from them for any one year the *most probable* relation between the variations in the amount of sugar that is consumed and the corresponding variations in price. In other words, our problem is to pass a good continuous curve through these observations.

At this point two questions or difficulties present themselves: First, what function shall be fitted to the data? Second,

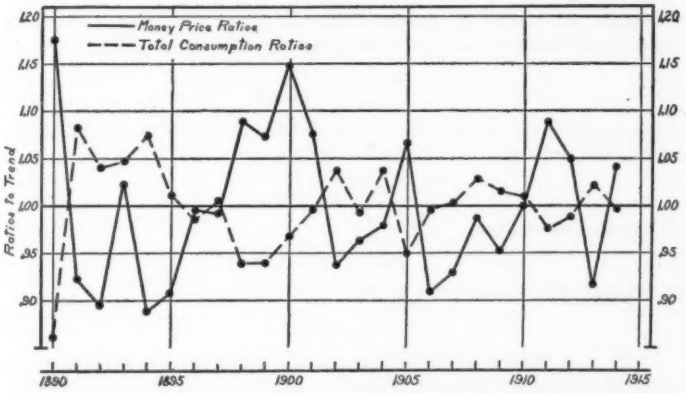

FIG. 10.—Inverse correlation between the trend ratios of the total consumption of sugar in the United States and the trend ratios of the wholesale money prices of sugar.

how shall the difficulty connected with the choice of the independent variable be overcome? The second difficulty has already been discussed.[19] We have seen that it is effectively overcome when, in the fitting of the curve, both variables are considered as being subject to error. The first difficulty does not arise at all when the regression is linear, for the use of the straight line is then clearly indicated. When the regression is skew, it will be found that the advantages of using Professor Moore's "typical equation to the law of demand"[20] are such as not to

[19] Cf. pp. 578–81.

[20] H. L. Moore, "Elasticity of Demand and Flexibility of Prices," *Journal of the American Statistical Association*, March, 1922.

Professor Moore's equation is based on a generalized treatment of the co-

make it worth our while to experiment much with other equations.

It is evident from the scatter diagram (Fig. 11) and from the usual tests for linearity of regression that the regression before us is quite linear. We take it, therefore, that the "best" demand curve within the limits of observation is given by the "normal line" N, or the "line of best fit." For comparative purposes, however, there are also graphed the straight lines A and

---

efficient of the elasticity of demand. Assuming that the *reciprocal* of this coefficient is a linear function of the amount demanded, he writes

$$\frac{dy}{dx}\cdot\frac{x}{y}=\alpha+\beta x \qquad \text{(i)}$$

where x stands for the amount demanded and y stands for the price per unit. The foregoing equation may be put in the form

$$\frac{dy}{y}=\alpha\frac{dx}{x}+\beta dx\,.$$

Integrating, he obtains

$$\log_e y=\alpha\log_e x+\beta x+\log_e A\,.$$

Or, passing from logarithms to absolute numbers,

$$y=Ax^{\alpha}e^{\beta x}\,. \qquad \text{(ii)}$$

Equation (i) was reached on the assumption that the reciprocal of the elasticity of demand is a linear function of x. Making the hypothesis a little more complex by assuming that

$$\frac{dy}{dx}\cdot\frac{y}{x}=\alpha+\beta x+\gamma x^2 \qquad \text{(iii)}$$

Professor Moore derives the equation

$$y=Ax^{\alpha}e^{\beta x+\frac{1}{2}\gamma x^2} \qquad \text{(iv)}$$

which is his "typical equation to the law of demand in a slightly more complex form."

The great advantage of the "typical equation" is that it enables us immediately to write down the equation descriptive of the coefficient of elasticity of demand (or of its reciprocal), for (i) appears in the exponent of (ii), and (iii) appears in the exponent of (iv).

The general forms (ii) or (iv), Professor Moore shows, also hold when the equations are desired in the *ratio form*. Thus (ii) may be written

$$Y=A'X^{\alpha'}e^{\beta'X}\,. \qquad \text{(v)}$$

When the mean values of X and Y are, practically, 1.0, the value of A' is $e^{-\beta'}$ and consequently (v) becomes

$$Y=X^{\alpha'}e^{\beta'(X-1)}\,. \qquad \text{(vi)}$$

This is equation *B*, Figure 11.

A' and Moore's typical demand curves B and B'. The unaccented letters A and B are used to designate the curves giving

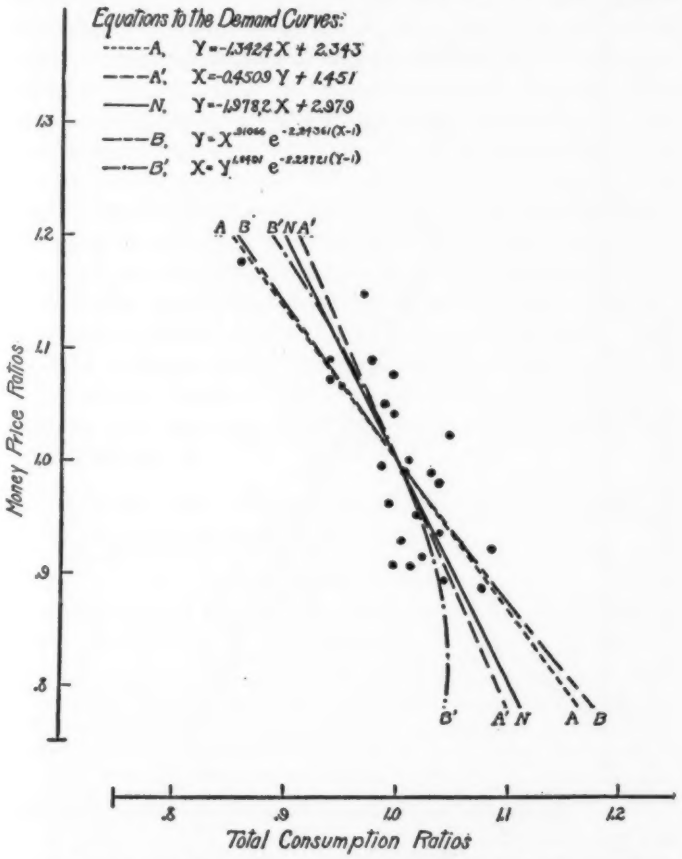

FIG. 11.—Scatter diagram of the trend ratios of the total consumption of sugar in the United States and the corresponding trend ratios of the wholesale money prices of sugar, and five fitted curves.

the regression of Y on X, the accented letters A' and B' are used to designate curves giving the regression of X on Y.

It is also clear that if we were compelled to follow the usual

practice of arbitrarily selecting either consumption or prices as the independent variable, we should have gotten better results

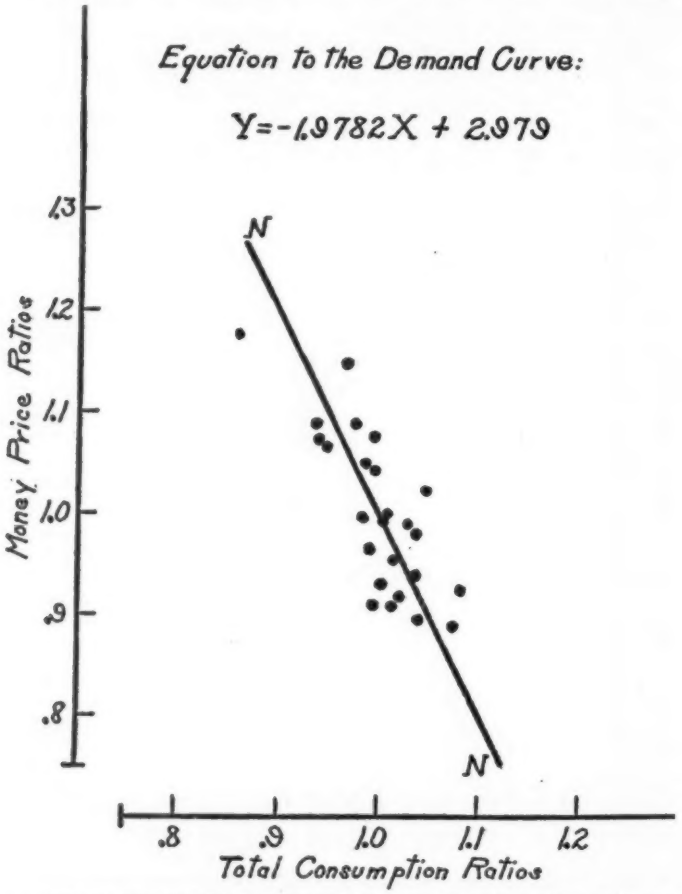

FIG. 12.—The "best" law of demand for sugar derived from the trend ratios of total consumption and the trend ratios of money prices.

by selecting the latter, for the curves A' and B' lie much closer to the "line of best fit" N than do the curves A and B.

Furthermore, it will be seen that in the problem before us

nothing is gained through the use of the more complicated curve B or B' so long as one of the variables is considered to be free from errors of observation, and that when both variables are treated as being affected by errors, the straight line N gives as good a fit as can be expected.[21] (See also Fig. 12.) Of course, it might be argued that if the "typical equation" were also fitted on the assumption that both X and Y are subject to error, we should obtain a curve which is superior to the straight line N for purposes of extrapolation. Without stopping to consider the mathematical difficulties which must be overcome if the newer method of curve-fitting is to be applied to the more complicated functions, we may reply that to extend *any* empirical demand curve much beyond the range of observation is not a safe procedure, as is evident from curve B' (Fig. 11), and that in most practical problems the extreme ends of the demand curve are of no importance anyway.[22] We therefore conclude that the "best" demand curve that may be derived from the data before us is the straight line N.

3. THE LAW OF DEMAND IN TERMS OF TREND RATIOS

The equation to our demand curve is

$$Y = -1.9782\,X + 2.979 \qquad (7)$$

the origin being at 0,0. This means that, based upon the experience from 1890 to 1914, an increase of one *point* (or, roughly, 1

[21] In comparing the straight lines with the other curves of Figure 11, allowance must be made for the fact that the former were fitted to the absolute values of the trend ratios, while the latter were fitted to the logarithms of these values, without making any allowance for the difference in weighting thus introduced. The same curve may sometimes give widely different results, depending upon whether it was fitted by minimizing the sum of the squares of the absolute figures or of their logarithms.

By properly weighting the logarithms of the trend ratios it is possible to fit the curves B and B' so as to make the sum of the squares of the absolute figures a minimum. At the time of fitting, however, we believed (perhaps erroneously) that the extra labor involved would not be worth while.

Perhaps it is also worth while to mention in this connection that the method of fitting which takes the errors in both variables into consideration can be applied not only to the straight line but to all curves which are reducible to linear form by logarithmic or other transformation.

[22] See Marshall, *Principles of Economics* (8th edition), p. 133 and note.

per cent) in the (trend) ratio of consumption is correlated with a drop of 1.98 *points* in the (trend) ratio of the price, or that an increase of one *point* in the price ratio is associated with a decrease of only $1/1.9782=0.51$ of a *point* in the consumption ratio.

By means of this equation it is possible to estimate the probable change in the price corresponding to a given change in consumption, or the probable change in consumption corresponding to a given change in price. In 1914, the consumption of sugar in the United States amounted to 4,212,000 short tons. What was the probable price of sugar in the same year? The "normal" consumption or the "trend" of consumption in 1914 was 4,231,000 tons. (See Table II of Appendix II.) The consumption ratio was, therefore, $4{,}212{,}000 \div 4{,}231{,}000 = 0.996$. Substituting this value for X in equation (7) and solving for Y we find that $Y=1.009$, or the probable price would be 1.009 of the "normal" or "trend" price. Since the trend price for 1914 was 4.493 cents (see Table II of Appendix II), this value of Y would give 4.533 as the probable price for 1914. The corresponding probable price obtained by the method of link relatives was, it will be recalled, 4.536 cents. The very close agreement between these two estimates is, of course, accidental. In like manner this equation can be used for estimating changes in consumption from given changes in price.

4. THE LAW OF DEMAND IN TERMS OF ABSOLUTE QUANTITIES

Equation (7) gives the most probable relation which existed between the consumption ratios and the price ratios of sugar during the interval 1890–1914. It is the law of demand for sugar in the ratio form. Professor Moore has shown,[23] however, that a simple transformation makes it possible to take the next step—the derivation of the law of demand for any one year in terms of absolute quantities. By definition, $X=x/T_x$ and $Y=$

[23] H. L. Moore, *op. cit.*, p. 16.

y/T_y. By making these substitutions in (7) the law of demand for sugar in the absolute form becomes

$$y = -1.9782\,(T_y/T_x)x + 2.9782\,T_y \qquad (8)$$

which may also be written

$$x = -0.5055(T_x/T_y)y + 1.5055\,T_x\,. \qquad (8a)$$

If, for example, it is desired to ascertain the law of demand for sugar in 1914 in a form convenient for estimating prices from consumption, all that we have to do is to find the trend of consumption for 1914, T_x, and the trend of prices for 1914, T_y, and substitute these values in (7). The values of T_x and T_y for any one year between 1890 and 1914 are given in Table II of Appendix II. Substituting the values of T_x and T_y for 1914 in (7) we obtain

$$y = -0.000{,}002{,}101\,x + 13.381\,.$$

That is to say, a change of 100,000 tons in consumption would, in 1914, have been associated with an inverse change in price of 0.21 of one cent. The corresponding figure derived by the method of link relatives (see equation [5]) is 0.19 of one cent. The present estimate is, however, more reliable, since the two series of trend ratios are more highly correlated than are the corresponding series of link relatives.

If, on the other hand, we should desire to write the same equation in a form more convenient for estimating consumption from price, all that we would have to do is to substitute the values T_x and T_y in (8a) instead of in (8), which, for 1914 becomes

$$x = -476{,}000\,y + 6{,}370{,}000\,.$$

The corresponding equations for 1904 and 1914 are

$$x = -310{,}000\,y + 4{,}500{,}000$$

and

$$x = -229{,}000\,y + 3{,}157{,}000$$

respectively. That is to say, a rise or fall in the price of sugar of one cent per pound would have decreased or increased consumption by 229,000 tons in 1894, by 310,000 tons in 1904, and by

476,000 tons in 1914. These estimates are to be preferred to those obtained by the method of link relatives and given on page 584, since the trend ratios on which they are based are more highly correlated than are the corresponding link relatives. For the same reason it is also fair to assume that the foregoing equations provide a better measure of the shifting of the demand curve from year to year than is provided by the corresponding equations derived by the method of link relatives (see p. 584).

5. THE COEFFICIENT OF THE ELASTICITY OF DEMAND

After the law of demand has been ascertained in one form or another—absolute quantities, link relatives, or trend ratios—it is a simple matter to find the coefficient of the elasticity of demand at any point on the demand curve. When the law of demand is given in terms of absolute quantities, then, by definition, $\eta=\frac{dx}{dy}\cdot\frac{y}{x}$, where x and y are absolute (observed) consumption and prices, respectively. We have proven on pages 587–88 that when the law of demand is given in terms of link relatives, $\eta=\frac{dX}{dY}\cdot\frac{Y}{X}$, where X and Y are the link relatives of consumption and prices, respectively. It can also be shown[24] that the same form holds when the law of demand is given in the trend-ratio form, i.e., when $X=\frac{x}{T_x}$ and $Y=\frac{y}{T_y}$. Applying this formula to the equations of the demand curves on Figure 11, and recalling that the equations to curves B and B' are particular forms of Professor Moore's "typical equation to the law of demand" which enable us immediately to write down the equation descriptive of the coefficient of elasticity of demand (see footnote on pp. 597–98), we obtain

$$\left.\begin{aligned}
\eta_A &= -(1/1.3424)Y/X \\
\eta_{A'} &= -0.4509\,Y/X \\
\eta_N &= -(1/1.9782)\,Y/X \\
\eta_B &= 1/(0.91066-2.24361\,X) \\
\eta_{B'} &= 1.8491-2.28721\,Y
\end{aligned}\right\} \qquad (9)$$

[24] Moore, *op. cit.*, p. 19.

where the subscripts A, A', etc., denote the demand curves from which these equations are derived. In Figure 13 these equations are graphed for a considerable range of values of X.

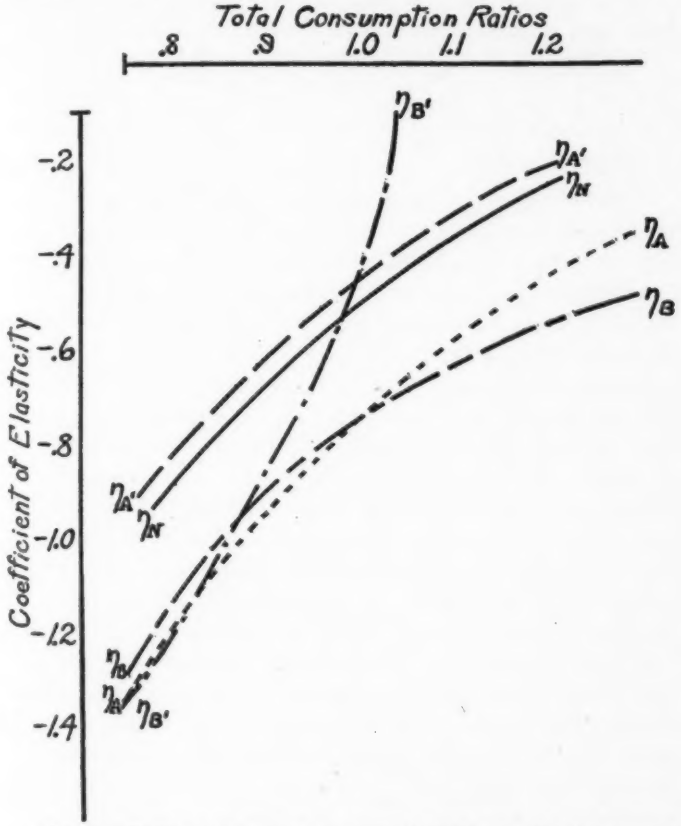

FIG. 13.—Elasticity of demand for sugar derived from the five demand curves of Figure 11.

It will be seen that there is a considerable discrepancy between the results: (1) when different curves are used for the demand curve, and (2) when the assumption is made that either X or Y is free from error. This discrepancy, however, does not

invalidate the method. It simply shows "the need of care in drawing conclusions that are based upon the numerical values of the coefficient of elasticity." In the words of Professor Moore,

> When different measures of degrees of elasticity are afforded by different types of curves, there is a perfectly satisfactory criterion which makes it possible to decide between different coefficients of elasticity: The coefficient is to be preferred which is deduced from the demand curve that fits the data with the highest degree of probability. The demand curve that fits best the data affords the best measure of the degree of elasticity of demand.[25]

We have seen that the demand curve that fits the data with the highest degree of probability is the line N (Figs. 11 and 12). We conclude, therefore, that the curve η_N (Fig. 13) affords the best measure of the degree of elasticity of demand, for it is deduced from the equation to the line N. From this curve it is clear that the elasticity of demand is higher for low consumption (or high prices) than it is for high consumption (or low prices). For example, when $X=1$, that is to say, when the consumption of sugar in any year is "normal," or is equal to that indicated by the trend for the same year, then $\eta=-0.51$, or a reduction in the price of 1 per cent will increase consumption by 0.51 of one per cent. When $X=1.1$, that is to say, when the consumption for any year is already 10 per cent above "normal" or above that indicated by the trend for the same year, then $\eta=-0.37$, or a reduction of 1 per cent in the price will increase consumption by only 0.37 of 1 per cent. When $X=0.9$, that is to say, when consumption for any year is 10 per cent below "normal" or below that indicated by the trend for the same year, then $\eta=-0.67$, or a reduction of 1 per cent in price will increase consumption by 0.67 of one per cent.

6. COMPARISON WITH THE METHOD OF LINK RELATIVES

These figures naturally invite a comparison with the results obtained by the method of link relatives (see p. 588). But before we can draw any conclusions from differences between coefficients of elasticity of demand, we must be sure that the coefficients relate to *comparable points* on the demand curve under

[25] *Economic Cycles*, p. 84.

consideration. That is to say, considering that the two methods have different interpretations, we must find the unit of link relative which corresponds to a given unit of trend ratio.

A comparison of Figure 12 or Figure 11 with Figure 5 suggests that the most comparable points on the two demand curves are the ones whose co-ordinates are given by the arithmetic means of the variables under consideration. We also know that deviations from these points will be comparable (assuming that they are measured in the same direction from the mean) if account is taken of the difference between the standard deviations of the series under comparison. The mean of the (total consumption) trend ratios is 1.0, and the mean of the (total consumption) link relatives is 1.0415. That is to say, a "normal" consumption in terms of link relatives is one which exceeds the consumption for the previous year by 4.15 per cent.[26] The standard deviation of the (consumption) trend ratios is 0.0458 and the corresponding figure for link relatives is 0.0629. The two standard deviations are in the ratio of 1.0 to 1.3734, which means that a deviation of $\pm$ 1.0 unit from the mean of the trend ratios corresponds to a deviation of $\pm$ 1.3734 units from the mean of the link relatives. It follows, therefore, that (consumption) trend ratios of 0.9, 1.0, and 1.1 correspond to link relatives of 0.9042, 1.0415, and 1.1788, respectively. When the coefficient of elasticity of demand is computed for *comparable points* on the two demand curves, the results obtained by the method of link relatives do not differ materially from those obtained by the method of trend ratios. Thus, for the three trend ratios given above, the coefficients of the elasticity of demand are —0.67, —0.51, and —0.37, respectively; for the corresponding link relatives the coefficients are —0.72, —0.52, and —0.34 respectively.

Our conclusions regarding the elasticity of demand for sugar may, then, be summarized as follows: When the consumption for any year is "normal," that is to say, when it is equal to that indicated by the trend of consumption for the same year, or

[26] In general, however, the arithmetic mean of the link relatives is not a good measure of the average annual increase.

when it exceeds the consumption for the year immediately preceding by 4 per cent, then $\eta=-0.5$, or a decrease in price of 1 per cent will increase consumption by 0.5 of 1 per cent. The elasticity of demand under other conditions of consumption may be read off from the graph of η_N in Figure 13.

VIII. THE METHOD OF LINK RELATIVES APPLIED TO THE ADJUSTED DATA

In the two preceding sections we have derived the law of demand for sugar from unadjusted data, i.e., from prices which have not been deflated by an index number of prices and from consumption which has not been reduced to a per capita basis. We have employed two separate methods—the method of link relatives and the method of trend ratios—and have shown that although both methods yield good results, the latter is superior to the former in the problem before us. The same methods may, however, also be applied to per capita consumption and real prices. Would the use of these adjusted series yield still better results? The present section will contain an answer to this question in so far as it applies to the method of link relatives. The next section will deal with the method of trend ratios. As most of the problems which arise in the application of these methods have already been discussed, they will be touched upon only slightly in the following pages.

In Table I A of Appendix II, there are recorded, for the period of 1890–1914, the annual per capita consumption of sugar, the corresponding real prices, the link relatives of per capita consumption, and the link relatives of the real prices. The coefficient of correlation between the two series of link relatives is $r=-0.67\pm.08$. The corresponding coefficient of correlation derived from the unadjusted data is[37] $r=-0.68\pm0.07$. In the problem before us, then, there is no advantage to be derived from the use of adjusted data. It is desirable, however, to complete the computations and derive the law of demand for sugar from per capita consumption and real prices as we have derived it from total consumption and money prices.

[37] Cf. p. 578.

A graphic representation of the negative correlation existing between the two series of link relatives is to be found in Figure 14.[28] The scatter diagram of the link relatives is shown in Figure 15. (Compare Fig. 14 with Fig. 4 and Fig. 15 with Fig. 5.)

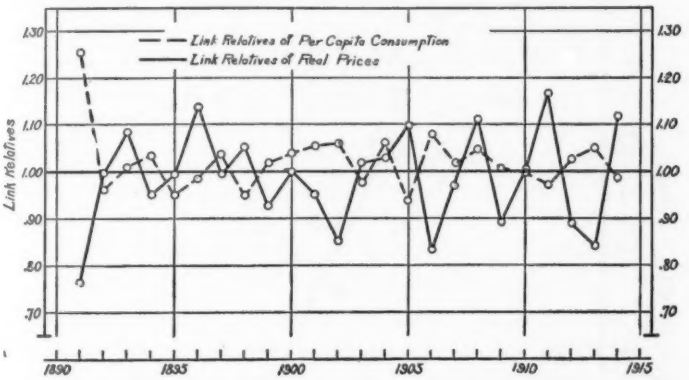

FIG. 14.—Inverse correlation between the link relatives of the per capita consumption of sugar in the United States and the link relatives of the real wholesale prices of sugar.

1. THE LAW OF DEMAND IN TERMS OF LINK RELATIVES

In Figure 15 there are also shown the two lines of regression, A and A', and the "line of best fit," N. The equation to the latter is

$$Y = -2.0817\,X + 3.113 \qquad (10)$$

the origin being at 0,0. This equation tells us that, based upon the experience from 1890 to 1914 inclusive, an increase or decrease of one *point* (or, roughly, 1 per cent) in the link relative of per capita consumption is, on the average, associated with a fall or rise of 2.08 *points* in the link relative of the real price. Another way of saying the same thing is that a change of one

[28] All data relating to per capita consumption and real prices are represented by rings ○ to distinguish them from the data relating to total consumption and money prices, which are represented by closed circles ●.

point in the link relative of the real price is, on the average, associated with an inverse change of 1/2.0817=0.48 of one *point* in the link relative of per capita consumption.

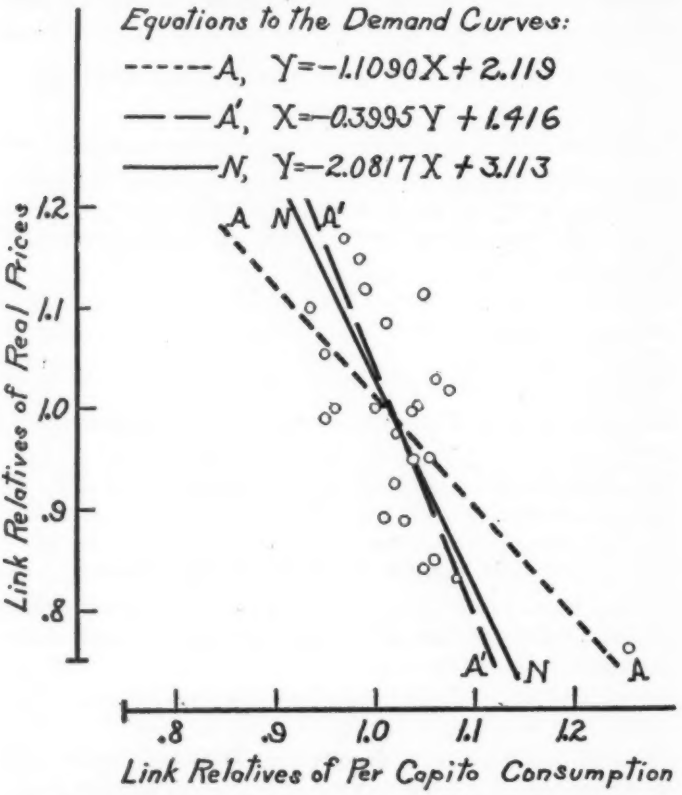

FIG. 15.—Scatter diagram of the link relatives of the per capita consumption of sugar and the corresponding link relatives of the real wholesale prices of sugar, with the lines of regression (*A* and *A'*) and the "line of best fit" (*N*).

This equation enables us to estimate the probable change in the real price corresponding to a given change in the per capita consumption, or the probable change in the per capita consumption corresponding to a given change in the real price. In 1913

the per capita consumption of sugar in the United States was 85.4 pounds. In 1914 the consumption was 84.3 pounds. What was the probable real price of sugar in 1914? The change in the per capita consumption as measured by the link relative was 84.3/85.4=0.987 (see Table I A of Appendix II). Substituting this value for X in equation (10) and solving for Y, we find that the probable real price would be 1.058 of the real price for the preceding year. Since the real price for 1913 was 3.730 cents, this value of Y would give 3.947 cents as the probable real price for 1914. The observed real price was 4.166 cents—a difference of 5 per cent. In like manner we can estimate the probable change in consumption corresponding to a given change in price.

2. THE LAW OF DEMAND IN TERMS OF ABSOLUTE QUANTITIES

Equation (10) is the law of demand for sugar in terms of the *link relatives* of the per capita consumption and the *link relatives* of the real prices. As in the case of equation (4), however, a simple transformation makes it possible to derive the law of demand for any one year in terms of *absolute* per capita consumption and real prices. By definition, $X=\frac{x}{x_0}$, and $Y=\frac{y}{y_0}$, where x_0 and y_0 are respectively the per capita consumption and the real prices in the preceding or base year. By making these substitutions in (10), the law of demand in the absolute form becomes

$$y=-2.0817\,(y_0/x_0)x+3.113y_0 \qquad (11)$$

which may also be written

$$x=-0.4804\,(x_0/y_0)y+1.495x_0 \qquad (11a)$$

These equations are equivalent to (5) and (5*a*) respectively, and are to be used in the same way.

As an example, suppose that it is desired to have the law of demand for sugar in 1914 in a form convenient for estimating

price from per capita consumption. From Table I A of Appendix II, we find that the per capita consumption (x_0) and the real price (y_0) for the previous year, or 1913, were 85.4 and 3.730, respectively. Substituting these values of x_0 and y_0 in (11), we obtain

$$y = -0.09092\,x + 11.611$$

as the law of demand for sugar in 1914. This equation gives the probable real price corresponding to *any* given per capita consumption in that year. The observed per capita consumption in 1914 was 84.3 pounds. What was the probable real price? Substituting this value for x in the foregoing equation, we obtain 3.947 cents as the probable real price in 1914. The observed real price was 4.166 cents—a difference of 5 per cent.

Suppose now that it is desired to have the law of demand for 1914 in a form more convenient for estimating per capita consumption from real prices. Substituting the values given above for x_0 and y_0 in (11*a*), we obtain

$$x = -10.999\,y + 127.67$$

as the desired equation. By way of comparison we give the corresponding equations for 1904 and 1894. These are

$$x = -7.242\,y + 106.00$$

and

$$x = -5.641\,y + 96.28$$

respectively. That is to say, a rise or fall in the real price of sugar of one cent per pound would have decreased or increased the *per capita consumption* by 5.6 pounds in 1894, by 7.2 pounds in 1904, and by 11.0 pounds in 1914. Corresponding equations may, of course, be derived for all the other years between 1890 and 1914. Such equations provide a quantitative measure of a phenomenon in which economists are greatly interested—the degree to which the "demand schedule" changes from year to year. In section ix, however, a more satisfactory method of determining these equations will be presented.

3. THE COEFFICIENT OF THE ELASTICITY OF DEMAND

From equation (10), the coefficient of the elasticity of demand is

$$\eta=\frac{dX}{dY}\cdot\frac{Y}{X}=-\frac{1}{2.0817}\frac{Y}{X}=-0.4804\frac{Y}{X}. \qquad (12)$$

When $X=1$, that is to say, when there is no change in the per capita consumption between any two consecutive years, then $\eta=-0.4804\ (1.0313)=-0.50$, or a reduction in price of 1 per cent will increase consumption by 0.50 of 1 per cent. But the "normal" condition of per capita consumption during the period 1890–1914 was characterized by an average annual increase of about 2 per cent. (The means of the link relatives are $\overline{X}=1.0215$, $\overline{Y}=0.9864$.) When the per capita consumption for any year is "normal," that is to say, when it exceeds the consumption for the previous year by 2 per cent, then $\eta=-0.46$, or a decrease in price of 1 per cent will increase consumption by 0.46 of 1 per cent. Had we arbitrarily selected line A or line A' for our law of demand, we should have obtained as the corresponding value for η either -0.87 or -0.39, respectively.

IX. THE METHOD OF TREND RATIOS APPLIED TO THE ADJUSTED DATA

In Figure 16 there is graphed, for the period of 1890–1914, the observed trend of the per capita consumption of sugar. In Figure 17 there is graphed the observed trend of the corresponding real prices. With each observed trend there are also shown four fitted trends—a straight line, a quadratic, a cubic, and a quartic.[29] It is interesting to observe that while the per capita consumption of sugar increased from 52.8 pounds in 1890 to 84.3 pounds in 1914, the real price declined from 6.643 cents to 4.166 cents during the same period.

[29] In the equations to these trends, x = observed per capita consumption in pounds; y = observed real price in cents (B.L.S. index for 1900–09 = 1.00); T_x = per capita consumption computed from trend; T_y = real price computed from trend; t = time in years, the origin being at July 1, 1902.

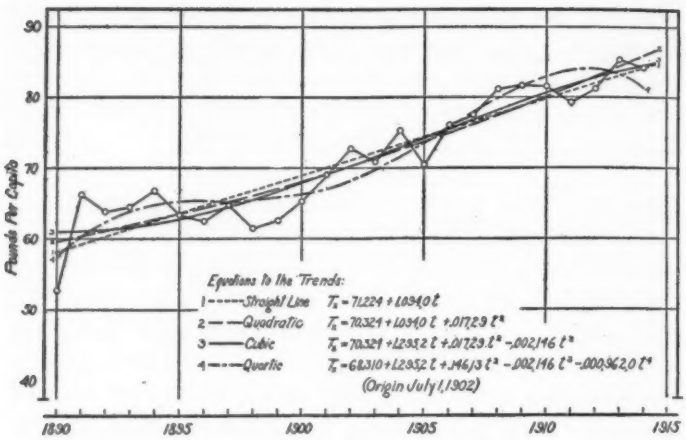

FIG. 16.—Per capita consumption of sugar in the United States, 1890–1914, and four fitted trends.

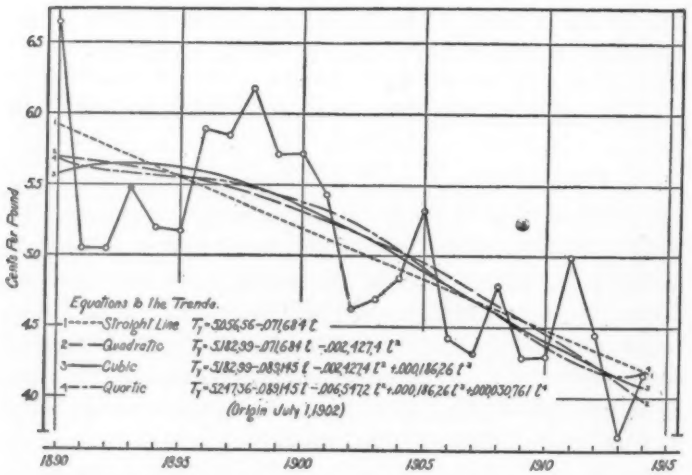

FIG. 17.—Real prices of refined sugar at New York, 1890–1914, and four fitted trends.

I. POSSIBLE OBJECTIONS

In view of the inverse secular movements of per capita consumption and real prices, it may be asked, "Why have recourse to trend ratios at all? Is not the decline in the real price of sugar the *cause* of the increase of the per capita consumption? Why not correlate the figures as they stand?" Indeed, the degree of correlation between the observed per capita consumption and observed real prices is higher than that found between any of the series of trend ratios or link relatives hitherto observed, r being -0.90 ± 0.03. The position taken in this study, however, is that the existence of a trend in any series—per capita consumption or total consumption, real prices or money prices—ought to make us suspect the existence of disturbing factors which might produce a spurious correlation. (One obvious factor which may cause a spurious correlation is the growing taste for sugar.) The upward trend of the per capita consumption of sugar during the period under consideration *may* have been caused by the downward trend of the real prices. It is safer to assume, however, that there is no bona fide, organic relation between the trends. For if it is reasonable to expect a bona fide relation between the two trends, it is also reasonable to expect that the elasticity of demand derived from these series would be of the same order of magnitude as those obtained by the three methods described above—say -0.5. But a computation shows that the observed per capita consumption and the observed real prices (both variables uncorrected for trend) are connected by the equation.

$$y = -0.07336\,x + 10.2820 \qquad (13)$$

where x = per capita consumption in pounds, and y = real prices in cents, the origin being at 0,0. According to this equation, the coefficient of the elasticity of demand at the mean of the variables ($\bar{x} = 71.224$, $\bar{y} = 5.057$) is $\eta = -0.97$. That is to say, the elasticity of demand derived from the series under consideration is 100 *per cent greater* than any of those derived thus far. We conclude, therefore, that the trends must be eliminated, as their retention introduces an element of spurious correlation.

In other words, the use of per capita consumption and real prices does not, in the problem at hand, do away with the necessity of having recourse to the method of trend ratios or to a similar method.

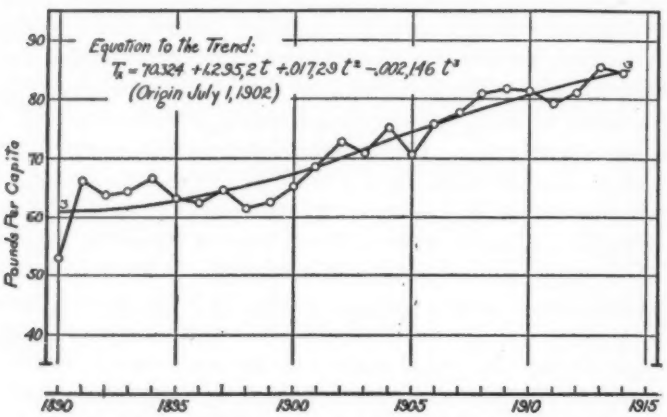

FIG. 18.—The "best" trend of the per capita consumption of sugar in the United States, 1890–1914.

2. THE SELECTION OF A SUITABLE TREND

In selecting a suitable trend for each of our adjusted series (see Figs. 16 and 17), we are in a position to benefit from our experiments with the trends of the unadjusted series.[80] Accordingly, we select, by inspection, the third-degree parabolas as giving the "best" compromises between smoothness and goodness of fit. Figure 18 shows the "best" trend of per capita consumption, and Figure 19 shows the "best" trend of real prices, for the period under consideration.

In Table II A of Appendix II, there are recorded the observed per capita consumption and the observed real prices of sugar; the "normal" per capita consumption and the "normal" real price as computed from the most satisfactory trends; and the consumption ratios (X) and the price ratios (Y). The co-

[80] See pp. 589–95, and Figs. 6–9.

efficient of correlation between the two series of trend ratios is $r=-0.80\pm0.05$. A graphic presentation of the inverse move-

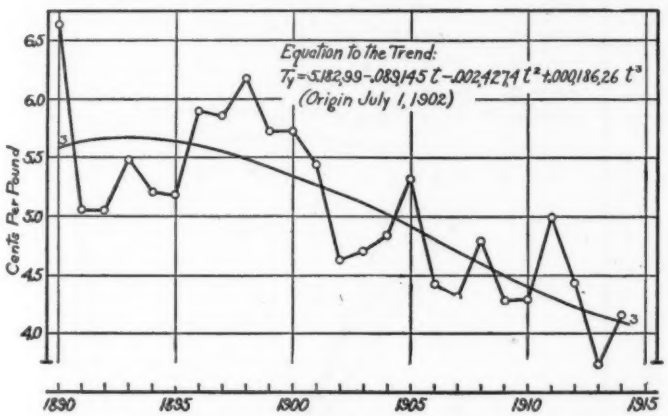

FIG. 19.—The "best" trend of the real wholesale prices of refined sugar at New York.

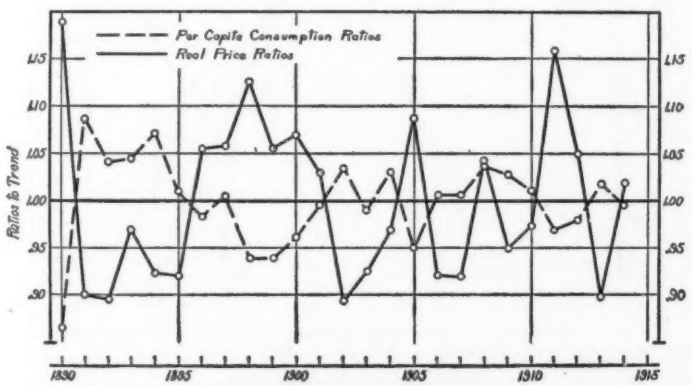

FIG. 20.—Inverse correlation between the trend ratios of the per capita consumption of sugar in the United States and the trend ratios of the real wholesale prices.

ment of the trend ratios is given by Figure 20. As the correlation between the corresponding trend ratios of *total* consumption and

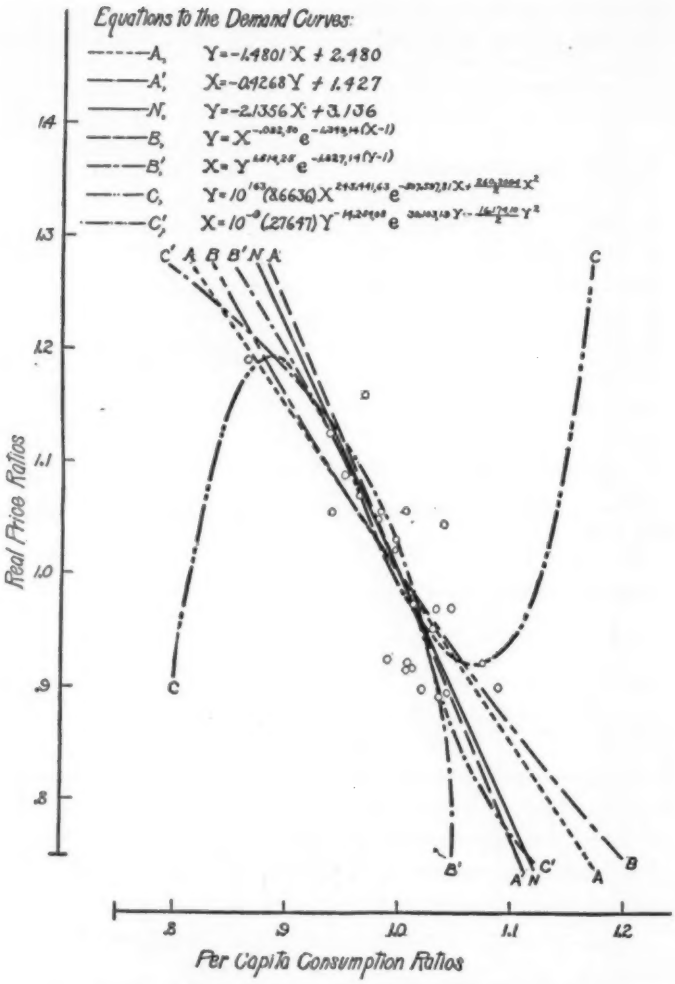

FIG. 21.—Scatter diagram of the trend ratios of the per capita consumption of sugar in the United States and the corresponding trend ratios of the real wholesale prices of sugar, and seven fitted curves.

money prices is, as we have seen, just as high ($r=-0.78\pm 0.05$), we conclude that, in the problem before us, no signifi-

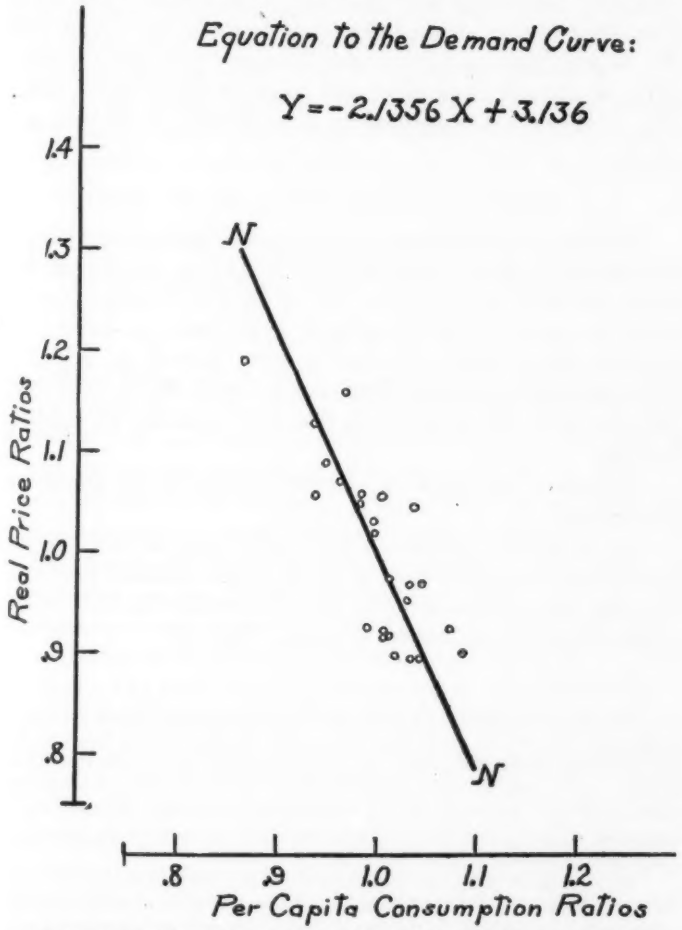

FIG. 22.—The "best" law of demand for sugar derived from the trend ratios of per capita consumption and the trend ratios of real prices.

cantly more accurate law of demand for sugar may be derived from per capita consumption and real prices than that which we

have derived from total consumption and money prices. (Compare Fig. 20 with Fig. 10.) In view, however, of our previous remarks[31] concerning the importance of eliminating the trend even when we use adjusted data, it is desirable to proceed with the computations and derive the demand curve and the elasticity of demand from the trend ratios of the adjusted data. The results of the computations are exhibited in Figures 21, 22, 23.

3. COMPARISON OF SEVERAL TYPES OF DEMAND CURVES

In Figure 21 there are shown the results obtained by fitting a straight line and two forms of Moore's "typical equation to the law of demand" to our data: (1) when it is assumed that Y alone is subject to error (curves A, B, C), and (2) when it is assumed that X alone is subject to error (curves A', B', C'). For comparative purposes there is also shown the straight line (line N) obtained by assuming that *both* variables are subject to error.

A study of the curves of Figure 21 suggests the following conclusions:

1) When the regression is practically linear, as in the problem at hand, the use of more or less complex equations to represent the law of demand may give impossible results.[32] (See curve C, Fig. 21, and curves η_c and $\eta_{c'}$, Fig. 23.)

[31] Cf. p. 615.

[32] In comparing the straight lines with the other curves of Figure 21, allowance must, however, be made for the fact that the former were fitted to the absolute values of the trend ratios, while the latter were fitted to the logarithms of these values, without making any allowance for the difference in weighting thus introduced. The same curve may sometimes give widely different results depending upon whether it was fitted by minimizing the sum of the squares of the absolute figures or of their logarithms.

By properly weighting the logarithms of the trend ratios it is possible to fit the curves B and B' and C and C' so as to make the sum of the squares of the absolute figures a minimum. At the time of fitting, however, we believed (perhaps erroneously) that the extra labor involved would not be worth while.

Perhaps it is also worth while to mention in this connection that the method of fitting which takes the errors in both variables into consideration can be applied not only to the straight line but to all curves which are reducible to linear form by logarithmic or other transformation.

2) The effect of assuming that only one of the variables is subject to error may be not only to modify the *slope* of the demand curve, as in the case of A and A', but also to change the direction of its *concavity*, as in the case of B and B'. (Curve B is concave upward, while curve B' is concave downward.)

3) The "best" demand curve is given by the "line of best fit" (line N) which was fitted on the assumption that both series of trend ratios are affected by errors. It is shown separately in Figure 22.

4. THE LAW OF DEMAND IN TERMS OF TREND RATIOS

The equation to our demand curve (line N) is:

$$Y=-2.1356\,X+3.136 \qquad (14)$$

the origin being at 0,0. This equation tells us that, based on the experience of 1890–1914, an increase of one *point* (or, roughly, 1 per cent) in the trend ratio of per capita consumption is, on the average, associated with a decrease of 2.14 *points* in the trend ratio of the real price, or that an increase of one *point* in the price ratio is, on the average, associated with a decrease of $1/2.1356=0.47$ of one *point* in the consumption ratio. The corresponding figures derived from the trend ratios of *total* consumption and *money* prices are 1.98 and 0.51 *points* respectively.

This equation enables us to obtain a better estimate of the probable real price from a given per capita consumption than that provided by equation (10), for the reason that the trend ratios are more highly correlated than the corresponding link relatives. This equation corresponds to equation (7), which gives the relation between the trend ratios of money prices and total consumption, and is to be used in the same way. For example, suppose that it is desired to find the probable real price of sugar in 1914. Referring to Table II A of Appendix II, we see that the ratio of the observed per capita consumption for 1914 to the trend of per capita consumption for the same year was 0.996. Substituting this value for X in (14) we find that $Y=$ 1.009, or the probable price would be 1.009 of the "normal" or "trend" price. Since the trend price for 1914 was 4.086 cents,

this value of Y would give 4.123 cents as the probable real price for 1914. The observed real price was 4.166 cents, which differs from the probable price by 1 per cent. The corresponding probable price obtained by the method of link relatives, it will be recalled, was 3.947 cents. In like manner we can estimate the probable change in per capita consumption corresponding to a given change in the real price.

5. THE LAW OF DEMAND IN TERMS OF ABSOLUTE QUANTITIES

Equation (14) gives the law of demand in the *ratio form*. That is to say, $X=x/T_x$ and $Y=y/T_y$ where x=observed per capita consumption; y=observed real prices; T_x=trend of per capita consumption; and T_y=trend of real prices. It was shown elsewhere,[33] however, that a simple transformation makes it possible to derive the law of demand for any one year in terms of *absolute quantities*. All that we have to do is to substitute for X and Y in (14) their values as given above. We obtain

$$y=-2.1356\,(T_y/T_x)x+3.136T_y \qquad (15)$$

or, with y as the independent variable,

$$x=-0.4683\,(T_x/T_y)y+1.468T_x\,. \qquad (15a)$$

(Compare [15] and [15*a*] with [8] and [8*a*], respectively.) In order, therefore, to ascertain the law of demand for any given year, it is necessary to find the values of T_x and T_y for that year and to substitute these values in (13) or (13*a*). (These values are given in Table II A of Appendix II.) The former equation is more convenient for estimating prices from consumption; the latter is more convenient for estimating consumption from price. These equations are equivalent to (8) and (8*a*) and are to be used in the same way.

Suppose, for example, that it is desired to have the law of demand for 1914 in a form convenient for estimating price from per capita consumption. From Table II A of Appendix II we find that T_x and T_y for 1914 amounted to 84.6 and 4.086, re-

[33] Cf. pp. 602–3.

spectively. Substituting these values of T_x and T_y in (15), we obtain

$$y = -0.1031\,x + 12.814$$

as the law of demand for sugar in 1914. This equation gives the probable real price corresponding to *any* given per capita consumption in that year. The actual per capita consumption in 1914 amounted to 84.3 pounds. Substituting this value for x in the foregoing equation and solving for y, we obtain $y = 4.123$, or the probable real price in 1914 was 4.123 cents. The observed real price was 4.166—a difference of 1 per cent. Such a close agreement between the probable price and the observed price is, of course, accidental. Similar equations may be obtained for all other years between 1890 and 1914.

Suppose now that it is desired to have the law of demand for 1914 in a form more convenient for estimating consumption from price. Substituting the values given above for T_x and T_y in (15*a*), we obtain

$$x = -9.696\,y + 124.22$$

as the desired equation. The corresponding equations for 1904 and 1894 are

$$x = -6.843\,y + 107.19$$

and

$$x = -5.160\,y + 91.33$$

respectively. In other words, a rise or fall in the real price of sugar of one cent per pound would have decreased or increased consumption by 5.2 pounds in 1894, by 6.8 pounds in 1904, and by 9.7 pounds in 1914. The corresponding figures obtained by the method of link relatives (see p. 612) are 5.6, 7.2, and 11.0 pounds, respectively. These estimates are, however, less reliable than those which we have just obtained through the use of equation (15*a*), as the link relatives are less highly correlated than the corresponding trend ratios.

Equations like the foregoing may, of course, be derived for the other years between 1890 and 1914. They provide a quantitative measure of the degree to which the "demand schedule" has shifted from year to year as a result of dynamic changes.

6. THE COEFFICIENT OF THE ELASTICITY OF DEMAND

We have shown elsewhere[34] that after the law of demand has been ascertained in one form or another—absolute quantities, link relatives, or trend ratios—it is a simple matter to find the coefficient of the elasticity of demand at any point on the demand curve. It can easily be shown that when the law of demand is given in the form of trend ratios, $\eta = \frac{dX}{dY} \cdot \frac{Y}{X}$, where X and Y are the trend ratios of consumption and prices, respectively. Applying this formula to the equations of the demand curves on Figure 21, and recalling that curves B, B', C, and C' are different forms of Professor Moore's "typical equation to the law of demand," which enables us immediately to write down the equations descriptive of the coefficient of elasticity of demand (see footnote on pp. 597–98), we obtain

$$\left.\begin{aligned}
\eta_A &= -(1/1.4807)Y/X \\
\eta_{A'} &= -0.4268\ Y/X \\
\eta_N &= -(1/2.1356)Y/X \\
\eta_B &= 1/(.0925 - 1.34914\ X) \\
\eta_{B'} &= 1.51425 - 1.92714\ Y \\
\eta_C &= 1/(245.441{,}63 - 507.597{,}81X + 260.20940X^2) \\
\eta_{C'} &= -14.25408 + 30.10319Y - 16.174{,}10Y^2
\end{aligned}\right\} \quad (16)$$

where the subscripts A, A', etc., denote the demand curves from which these equations are derived. In Figure 23 these equations are graphed for a considerable range of values of X.

A glance at the curves in Figure 23 is sufficient to warn us that great care must be exercised in drawing conclusions that are based upon the numerical values of the coefficient of elasticity of demand. The values of these coefficients fluctuate widely according to the type of curve that is selected to represent the law of demand and the method of fitting that is employed. Demand curves which look very much alike (curves A and B, or curves A' and N, Fig. 21) may yield radically different values for the coefficient of elasticity of demand (curves

[34] Cf. pp. 587–88, 604, 613.

η_A and η_B, or $\eta_{A'}$ and η_N, Fig. 23). It is highly important, therefore, to find the demand curve that fits the data with the highest

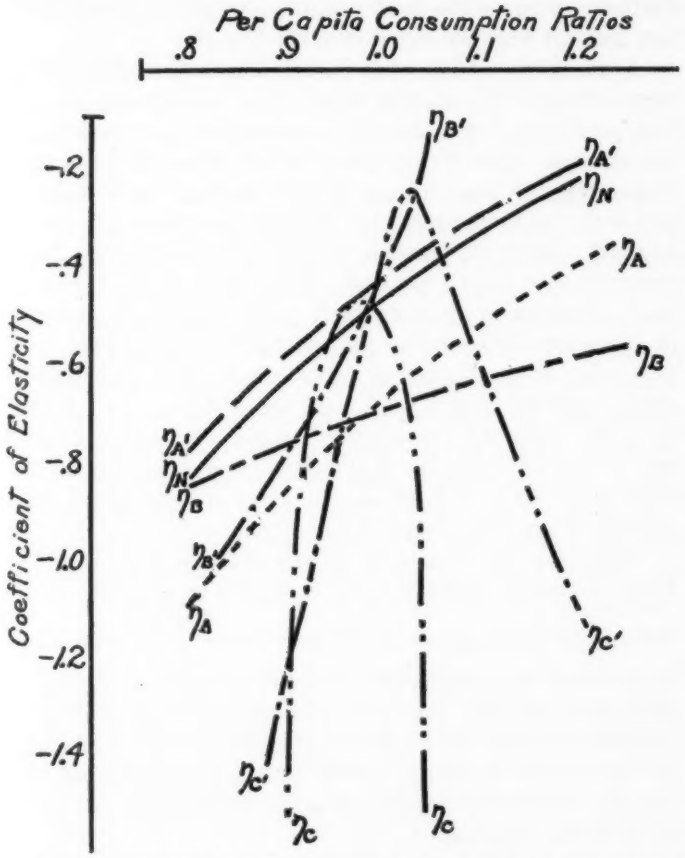

FIG. 23.—Elasticity of demand for sugar derived from the seven curves of Figure 21.

degree of probability. In this connection the method of fitting curves which considers both variables as being subject to errors of observation is of the greatest importance.

We have seen that the demand curve which fits the data

with the highest degree of probability is the line N (Figs. 21 and 22). We conclude, therefore, that the curve η_N (Fig. 21) affords the best measure of the coefficient of elasticity of demand, for it was deduced from the equation to the line N.

From this curve it is clear that the elasticity of demand for sugar is higher (in absolute value) for low consumption (or high prices) than it is for high consumption (or low prices). For example, when $X=1$, that is to say, when the per capita consumption of sugar for any year is "normal," or is equal to that indicated by the trend for the same year, then $\eta=-0.47$, or a reduction in the (real) price of one cent will increase consumption by 0.47 of 1 per cent. When $X=1.1$, that is to say, when consumption for any year is 10 per cent above "normal" or above that indicated by the trend for the same year, then $\eta=-0.33$, or a reduction of 1 per cent in price will increase consumption by only 0.33 of 1 per cent. When $X=0.9$, that is to say, when the consumption for any year is 10 per cent below "normal" or below that indicated by the trend for the same year, then $\eta=-0.63$, or a reduction of 1 per cent in price will increase consumption by 0.63 of 1 per cent.

When the law of demand for any one year is expressed in terms of absolute quantities, the coefficient of elasticity of demand is, of course, given by the formula $\eta=\frac{dx}{dy}\cdot\frac{y}{x}$, where x is the absolute consumption and y is the absolute price. By way of illustration, we may determine what the elasticity of demand would have been in 1914 had the per capita consumption in that year amounted to only 80 pounds instead of the observed 84.3 pounds. The law of demand for sugar in 1914 (see p. 623) is given by the equation

$$y=-0.1031\,x+12.814\,.$$

The probable price corresponding to a consumption of 80 pounds is, by this equation, equal to 4.566 cents. Hence

$\eta=\frac{dx}{dy}\cdot\frac{y}{x}=-\frac{1}{0.1031}\frac{4.566}{80}=-0.553$, or the coefficient of elasticity would have been -0.55.

7. COMPARISON WITH THE METHOD OF LINK RELATIVES

It was pointed out elsewhere (see p. 607) that before we can compare coefficients of elasticity of demand derived by different methods, we must be sure that they relate to the *comparable points* on the demand curves under consideration. It was also shown that a point on one demand curve will be comparable with a point on another demand curve if the deviations of the two points from their respective means have the same sign and if they are in the same ratio as the standard deviations of the two series under consideration. The mean of the (per capita consumption) trend ratios is 1.0, and the mean of the (per capita consumption) link relatives is 1.0215. That is to say, a "normal" consumption in terms of link relatives is one which exceeds the consumption for the previous year by 2.15 per cent. The standard deviation of the (consumption) trend ratios is 0.0461 and the corresponding figure for (consumption) link relatives is 0.0626. The two standard deviations are in the ratio of 1.0 to 1.3579, which means that a deviation of $\pm$ 1.0 unit from the mean of the trend ratios corresponds to a deviation of $\pm$ 1.3579 units from the mean of the link relatives. It follows, therefore, that (consumption) trend ratios of 0.9, 1.0, and 1.1 correspond to link relatives of 0.8855, 1.0215, and 1.1575, respectively. When the coefficient of elasticity of demand is computed for *comparable points* on the two demand curves, the results obtained by the method of link relatives (Equation [12]) are not materially different from those obtained by the present method (η_n Equation [16]). Thus, the values of the coefficient of the elasticity of demand for the three trend ratios given above are —0.63, —0.47, and —0.33, respectively. The values of the coefficient for the corresponding link relatives are —0.69, —0.46, and —0.29, respectively. It will be recalled that the two methods also yielded practically identical results when they were applied to unadjusted data, i.e., to total consumption and money prices.

This brings us to the end of the investigation of the law of demand for sugar as derived from adjusted data. We have seen

that, in the problem before us, the results obtained from the adjusted data are practically identical with those derived from the unadjusted data. It does not follow, however, that in another problem no advantage will be gained through the use of per capita consumption and real prices. All statistical devices are to be valued according to their efficacy in the immediate problem under consideration. If, for example, it is found that "deflated" prices give better results than observed money prices, the use of such adjusted prices needs no other justification for the purpose in view.

X. SUMMARY AND CONCLUSIONS

In Part I of this study we have briefly examined the concept of elasticity of demand, the assumptions that are inherent in the theoretical classical law of demand, and the difficulties that are met with in the derivation of concrete, statistical laws of demand. We have shown how these difficulties may be overcome, how both static and dynamic laws of demand may be derived, by modern statistical methods.

Proceeding to Part II, we have applied some of the simpler methods to the problem of finding the law of demand for sugar. We have derived this law of demand in four different ways and have found that the different methods give approximately the same value (−0.5) for the coefficient of elasticity of demand under normal conditions of consumption. That is to say, we have established the fact that, under normal conditions, an increase of 1 per cent in the price of sugar is associated with a decrease in consumption of only 0.5 of 1 per cent. We have defined "normal conditions" and have shown that even when the conditions of consumption differ considerably from normal, the coefficient of elasticity of demand is still numerically less than 1.0. The demand for sugar may, therefore, be designated as quite inelastic. In the course of our computations we have had occasion to call attention to the two difficulties that are inherent in the method of trend ratios. There is, first, the difficulty of selecting satisfactory trends from which to compute "normal"

consumption and "normal" prices; there is, second, the difficulty of taking into account the "errors" or deviations in *both* variables when we proceed to fit the demand curve. We trust that the statistical experiments which have been suggested by these difficulties, incomplete as they are, will be of some help to other workers in the same field.

In concluding this study we may call attention to some phases of the statistical law of demand which have not perhaps been sufficiently emphasized in the preceding pages.

1. The law of demand for sugar derived in this study is, strictly speaking, applicable to the period 1890–1914 only. Whether the same law holds today must be determined from a comparison of the present forces behind the demand and the supply of sugar with those which were in operation during the twenty-five years before 1915. In any event, the trend of consumption and the trend of prices for any year after 1914 may *not* be obtained, by extrapolation, from the corresponding trends for the period 1890–1914. The trends which are used in this study are satisfactory only within the limits of observation. They may give impossible results if extrapolated beyond these limits. The problem of deriving trends which may be used for extrapolation as well as interpolation has not been considered in this study. Of course, the whole difficulty of extrapolation might be avoided by using the law of demand based on link relatives or percentage changes. We have seen, however, that, with the data before us, this demand curve is not so satisfactory as that based on the trend ratios.

2. The coefficient of the elasticity of demand for sugar has been derived *from* the demand curve. As we have stated elsewhere,[35] it is our conviction that the accepted definition of the coefficient of elasticity of demand *presupposes* a knowledge of the demand curve, and that any attempt to derive the elasticity of demand for a commodity without first deriving the demand curve is apt to lead to difficulties. Professor Lehfeldt's deriva-

[35] Cf. *Journal of Political Economy*, XXXIII (October, 1925), 483–84.

tion of the elasticity of demand for wheat[36] illustrates this difficulty. See Appendix I.

3. The demand curves which were finally selected in this study are those which were fitted on the assumption that the reason why any point fails to fall on the curve is that it is subject to a horizontal as well as to a vertical "error." The "errors" with which we have to deal are not only, or even mainly, the *accidental* errors which are due to no known cause of systematic or constant error and which play such an important rôle in the theory of least squares. ***But they are treated as though they were true accidental errors.*** That is to say, we first eliminate such constant or systematic "errors" as may be eliminated through the use of index numbers, trend ratios, or link relatives. (Such constant or systematic "errors" are due, as a rule, to population growth and to changes in the general price level.) We are quite certain that there are others still, but we can not measure them. We therefore *assume* that they are eliminated by the graduation process involved in fitting the demand curve.[37]

4. The law of demand derived in this study is a *dynamic* law; it describes in summary form the "routine of change" of an important economic phenomenon. It is the dynamic law of demand in a simple form (link relatives or trend ratios). It is quite different from the static law of demand of the classical writers. "The statical law may be only approached (see equations 3 and 3*a*) but never realized in inductive investigation."[38]

5. The ease with which the general law of demand in terms of trend ratios or link relatives may be converted into a law of demand for any one year in terms of absolute quantities is of theoretical as well as practical importance. In the determination of the effects of a tax on the conditions of supply and in many related problems, it is necessary to have the cost or supply curve as well as the demand curve of the commodity in

[36] R. A. Lehfeldt, "The Elasticity of Demand for Wheat," *Economic Journal*, June, 1914.

[37] See Henri Poincaré, *Science and Hypothesis*, chap. xi, "The Calculus of Probabilities," section on "The Theory of Errors."

[38] Professor H. L. Moore in a letter to the present writer.

question. But the ordinary cost curve, for reasons which need not be discussed here, relates to a given year or date, and varies greatly from year to year. To compare such a cost curve, which is expressed in terms of absolute quantities, with a demand curve of the ratio or link-relative form is, of course, impossible, without making more or less complicated adjustments. The ease, however, with which the demand curve *for any one year* may be expressed in terms of absolute quantities[39] makes it possible to put the supply curve into juxtaposition with the proper demand curve.

Furthermore, an examination of the law of demand for successive years enables us to see the way in which the demand curve has shifted as a result of secular changes.

6. Finally, we should like to point out the real nature of the statistical law of demand. Some economists, among whom are to be included not a few members of the institutional school, have, unfortunately, gotten the impression that any attempt to derive a law of demand must needs be based on no better psychology than that of James Mill, A few of them even go so far as to deny the very existence of a law of demand. What these economists overlook, however, is that the existence of a law of demand is an objective fact, quite independent of one's psychological preconceptions. And when economists, in the words of Professor Mitchell, "grasp the idea that their business is with behavior, and that behavior is objective, they will see that their psychological footing can be made secure."[40] For the law of demand is not a fiction of the hedonistic school. It is nothing less than a summary presentation, in quantitative terms, of an important aspect of human behavior.

HENRY SCHULTZ

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[39] Cf. pp. 583–84, 602–3, 611–12, and 622–23.

[40] W. C. Mitchell, "The Prospects of Economics," in R. G. Tugwell, *The Trend of Economics*, p. 23.

APPENDIX I

COMMENTS ON PROFESSOR LEHFELDT'S METHOD OF DERIVING THE ELASTICITY OF DEMAND FOR WHEAT

Instead of first finding the law of demand for wheat and then deducing the elasticity of demand, Professor Lehfeldt removes the trends from the statistics of supply and prices, finds the standard deviations of the corrected series (or, rather, of the *logarithms* of the corrected series), and computes the coefficient of elasticity of demand from the formula:

$$\sigma_x/\sigma_y \qquad \text{(I)}$$

where σ_x is the standard deviation of the *logarithms* of the crops (supply) during the period under consideration, and σ_y is the standard deviation of the *logarithms* of the corresponding prices.[1] He finds that $\sigma_x=26.4$, $\sigma_y=43$, and concludes accordingly that $\eta=26.4/43=0.6$.

This procedure is open to the objection that it assumes the existence of perfect correlation between the variables when, by his own computations, the coefficient of correlation is $r=-0.44$. And when this moderate value of r is taken into consideration, it is not at all clear that the elasticity of demand for wheat is $\eta=-0.6$. A closer examination of Lehfeldt's method will throw some light on its *rationale*.

Professor Lehfeldt refers to 0.6 as being *the* elasticity of demand for wheat. This involves the assumption that the law of demand for wheat is a hyperbola of the form

$$xy^n=c \qquad \text{(II)}$$

otherwise the coefficient of elasticity of demand would vary from point to point on the demand curve. As he works with logarithms, equation (II) may be written as

$$\log x+n \log y=\log c \qquad \text{(II}a\text{)}$$

or, denoting the logarithms by capital letters and transposing,

$$Y=-mX+B \qquad \text{(II}b\text{)}$$

where $m=\frac{1}{n}$ is the slope, and $B=\frac{1}{n}\log c$ is the Y-intercept. When (IIb) is fitted to the data we may select for our demand curve either the regression of Y on X:

$$Y'=r\frac{\sigma_y}{\sigma_x}X' \qquad \text{(III)}$$

[1] We have taken the liberty of changing Lehfeldt's notation so as to conform to that used in this study.

or the regression of X on Y:

$$X' = r\frac{\sigma_x}{\sigma_y}Y' \qquad \text{(IIIa)}$$

the accents indicating that the variables are measured from their respective means. Since the coefficient of elasticity of demand is, by definition,

$$\eta = \frac{dx}{x} \Big/ \frac{dy}{y} = \frac{d \log x}{d \log y} = \frac{dX'}{dY'} \qquad \text{(IV)}$$

it is clear that we shall obtain two different values for $\eta = \frac{dX'}{dY'}$ depending upon whether we choose to derive it from (III) or (IIIa).

From III,

$$\eta = \frac{dX'}{dY'} = 1 \div \frac{dY'}{dX'} = \frac{\sigma_x}{r\sigma_y} = \frac{26.4}{(-0.44)(43.0)} = -1.4\,. \qquad \text{(V)}$$

From IIIa,

$$\eta = \frac{dX'}{dY'} = r\frac{\sigma_x}{\sigma_y} = \frac{(-0.44)(26.4)}{43.0} = -0.2. \qquad \text{(Va)}$$

It will be seen from the foregoing equations that Professor Lehfeldt's formula for the coefficient of elasticity of demand (i.e., $\eta = \sigma_x/\sigma_y$) is true only when r is numerically equal to 1.0.

We do not wish to be understood as saying that Professor Lehfeldt's figure of 0.6 is not a good first approximation to the elasticity of demand for wheat. Though the "line of best fit" gives a value for η of only -0.36, we cannot say definitely that it is a more probable value than Lehfeldt's figure because we are not acquainted with the nature of his data. Furthermore, we are in thorough agreement with him when he says, ". . . . the roughest attempt to measure a coefficient of elasticity would be better than none." All that we wish to point out here is that one cannot derive a satisfactory value of the elasticity of demand without first deriving the most probable demand curve.

APPENDIX II

TABLE I

THE TOTAL CONSUMPTION AND THE MONEY PRICES OF SUGAR IN THE UNITED STATES, AND THE LINK RELATIVES OF CONSUMPTION AND PRICES, 1890–1914

Year	Total Consumption (in Thousands of Short Tons) x	New York Wholesale Price of Refined Sugar (Yearly Averages in Cents per Lb.) y	Link Relatives of Consumption X	Link Relatives of Prices Y
1890	1,654	6.171	.....	.....
1891	2,116	4.641	1.279	0.752
1892	2,076	4.346	0.981	0.936
1893	2,136	4.842	1.029	1.114
1894	2,254	4.120	1.055	0.851
1895	2,184	4.152	0.969	1.008
1896	2,195	4.532	1.005	1.092
1897	2,319	4.503	1.056	0.994
1898	2,243	4.965	0.967	1.103
1899	2,327	4.919	1.037	0.991
1900	2,486	5.320	1.068	1.082
1901	2,657	5.050	1.069	0.949
1902	2,874	4.455	1.082	0.882
1903	2,856	4.638	0.994	1.041
1904	3,099	4.772	1.085	1.029
1905	2,948	5.256	0.951	1.101
1906	3,208	4.515	1.088	0.859
1907	3,353	4.649	1.045	1.030
1908	3,568	4.957	1.064	1.066
1909	3,649	4.765	1.023	0.961
1910	3,752	4.972	1.028	1.043
1911	3,754	5.345	1.001	1.075
1912	3,925	5.041	1.046	0.943
1913	4,192	4.278	1.068	0.849
1914	4,212	4.683	1.005	1.095

TABLE I A

THE PER CAPITA CONSUMPTION AND THE REAL PRICES OF SUGAR IN THE UNITED STATES AND THE LINK RELATIVES OF CONSUMPTION AND PRICES, 1890–1914

Year	Per Capita Consumption (in Pounds)	Real Price Per Pound* (in Cents)	Link Relatives of Per Capita Consumption X	Link Relatives of Real Price Y
1890	52.8	6.643	.....	.....
1891	66.3	5.061	1.256	0.762
1892	63.8	5.053	0.962	0.998
1893	64.4	5.484	1.009	1.085
1894	66.7	5.209	1.036	0.950
1895	63.4	5.171	0.951	0.993
1896	62.5	5.901	0.986	1.141
1897	64.8	5.863	1.037	0.994
1898	61.5	6.183	0.949	1.055
1899	62.6	5.720	1.018	0.925
1900	65.2	5.727	1.042	1.001
1901	68.7	5.574†	1.054	0.973
1902	72.8	4.626	1.060	0.830
1903	70.9	4.703	0.974	1.017
1904	75.3	4.840	1.062	1.029
1905	70.5	5.331	0.936	1.101
1906	76.1	4.422	1.079	0.829
1907	77.5	4.313	1.018	0.975
1908	81.2	4.803	1.048	1.114
1909	81.8	4.285	1.007	0.892
1910	81.6	4.294	0.998	1.002
1911	79.2	5.009	0.971	1.167
1912	81.3	4.441	1.027	0.887
1913	85.4	3.730	1.050	0.840
1914	84.3	4.166	0.987	1.117

* Real price = money price divided by Bureau of Labor Statistics index number of wholesale prices "all commodities," average 1900–1909 = 1.00.

† Throughout the computation the figure 5.436 was erroneously used in place of this one. The effect on the result is negligible.

TABLE II

THE TREND RATIOS OF THE TOTAL CONSUMPTION AND THE MONEY PRICES OF SUGAR IN THE UNITED STATES, 1890–1914

Year	Total Consumption (in Thousands of Short Tons) z	Ordinates of the Secular Trend of Consumption* T_z	Consumption Ratios $X=z/T_z$	Wholesale Price per Pound at New York (in Cents) y	Ordinates of the Secular Trend of Prices† T_y	Money Price Ratios $Y=y/T_y$
1890	1,654	1,923	0.860	6.171	5.248	1.176
1891	2,116	1,954	1.083	4.641	5.033	0.922
1892	2,076	1,994	1.041	4.346	4.862	0.894
1893	2,136	2,041	1.047	4.842	4.732	1.023
1894	2,254	2,097	1.075	4.120	4.639	0.888
1895	2,184	2,159	1.012	4.152	4.579	0.907
1896	2,195	2,229	0.985	4.532	4.548	0.996
1897	2,319	2,305	1.006	4.503	4.542	0.991
1898	2,243	2,388	0.939	4.965	4.558	1.089
1899	2,327	2,476	0.940	4.919	4.590	1.072
1900	2,486	2,569	0.968	5.320	4.636	1.148
1901	2,657	2,668	0.996	5.050	4.692	1.076
1902	2,874	2,771	1.037	4.455	4.753	0.937
1903	2,856	2,878	0.992	4.638	4.815	0.963
1904	3,099	2,989	1.037	4.772	4.876	0.979
1905	2,948	3,104	0.950	5.256	4.930	1.066
1906	3,208	3,222	0.996	4.515	4.974	0.908
1907	3,353	3,343	1.003	4.649	5.004	0.929
1908	3,568	3,466	1.029	4.957	5.016	0.988
1909	3,649	3,590	1.016	4.765	5.007	0.952
1910	3,752	3,717	1.009	4.972	4.971	1.000
1911	3,754	3,844	0.977	5.345	4.906	1.089
1912	3,925	3,973	0.988	5.041	4.807	1.049
1913	4,192	4,102	1.022	4.278	4.671	0.916
1914	4,212	4,231	0.996	4.683	4.493	1.042

* The equation to the secular trend of total consumption is $T_z=2{,}770.84+105.318t+2.124,2^p-0.063,52^p$. Origin at July 1, 1902.

† The equation to the secular trend of the money prices is $T_y=4.752,81+0.062,466t+0.000,819,2^p-0.000,652,2^p$. Origin at July 1, 1902.

TABLE II A

THE TREND RATIOS OF THE PER CAPITA CONSUMPTION AND REAL PRICES OF SUGAR IN THE UNITED STATES, 1890–1914

Year	Per Capita Consumption (in Pounds) x	Ordinates of the Secular Trend of Consumption* T_x	Consumption Ratios $X=x/T_x$	Real Price Per Pound† (in Cents) y	Ordinates of the Secular Trend of Prices‡ T_y	Real Price Ratios $Y=y/T_y$
1890	52.8	61.0	0.866	6.643	5.581	1.190
1891	66.3	61.0	1.087	5.061	5.622	0.900
1892	63.8	61.2	1.042	5.053	5.645	0.895
1893	64.4	61.6	1.045	5.484	5.653	0.970
1894	66.7	62.2	1.072	5.209	5.645	0.923
1895	63.4	62.8	1.010	5.171	5.624	0.919
1896	62.5	63.6	0.983	5.901	5.590	1.056
1897	64.8	64.5	1.005	5.863	5.545	1.057
1898	61.5	65.6	0.938	6.183	5.489	1.126
1899	62.6	66.7	0.939	5.720	5.424	1.055
1900	65.2	67.8	0.962	5.727	5.350	1.070
1901	68.7	69.0	0.996	5.574§	5.270	1.058
1902	72.8	70.3	1.036	4.626	5.183	0.893
1903	70.9	71.6	0.990	4.703	5.092	0.924
1904	75.3	73.0	1.032	4.840	4.996	0.969
1905	70.5	74.3	0.949	5.331	4.899	1.088
1906	76.1	75.6	1.007	4.422	4.799	0.921
1907	77.5	77.0	1.006	4.313	4.700	0.918
1908	81.2	78.3	1.037	4.803	4.601	1.044
1909	81.8	79.5	1.029	4.285	4.504	0.951
1910	81.6	80.7	1.011	4.294	4.410	0.974
1911	79.2	81.8	0.968	5.009	4.320	1.159
1912	81.3	82.9	0.981	4.441	4.235	1.049
1913	85.4	83.8	1.019	3.730	4.157	0.897
1914	84.3	84.6	0.996	4.166	4.086	1.020

* The equation to the secular trend of the per capita consumption of sugar is $T_x=70.324+1.295{,}21t+0.017{,}29t^2-0.002{,}146t^3$. Origin at July 1, 1902.

† Real price = money price divided by Bureau of Labor Statistics index number of wholesale prices "all commodities," average 1900–1909 = 1.00.

‡ The equation to the secular trend of the real price of sugar is $T_y=5.182{,}99-0.089{,}145t-0.002{,}427{,}4t^2+0.000{,}186{,}26t^3$. Origin at July 1, 1902.

§ Throughout the computation the figure 5.436 was erroneously used in place of this one. The effect on the result is negligible.

THE UTILITY CONCEPT IN VALUE THEORY AND ITS CRITICS

II. THE UTILITY CONCEPT IN WELFARE ECONOMICS

THE LEGITIMACY OF WELFARE ECONOMICS

In the recent literature on economic methodology, of which an outstanding characteristic has been the demonstration on a priori grounds of the lack of validity of the a priori method, protests recur, resting also on a priori grounds, against the conduct of economic analysis in welfare terms. One basis for such protests is that welfare is an ethical concept, involving the making of ethical evaluations, and that such evaluations are repugnant to the inherent nature of uncorrupted scientific analysis. There does not seem to be any essential conflict between this dogma of the laboratory and the use of the utility concept, not only in price-economics, but even in analysis intended to provide a basis for the making of welfare judgments.

Let us assume for the present that welfare consists of a flow of utility and that utility means satisfaction. Economists can accept satisfaction as a quantity, without committing themselves to any position with respect to its ethical quality. If they be welfare economists, they can consider the bearing of economic institutions and processes on "maximum satisfaction," but if they refrain from taking any position with respect to the goodness or the evil of these satisfaction consequences they will have succeeded in keeping their analysis free from ethical taint. Economics suffers, however, from the fact that it shares its terminology with other disciplines and with the language of common sense. The term "utility" suggests a particular school of ethics, while "welfare" is hard to distinguish from the *summum bonum* of most humanist schools of ethical doctrine. But economics can conceivably employ these concepts without giving them ethical meaning within the proper limits of its own range of inquiry. If economics wishes to make its findings helpful in the making of

ethical appraisals, which is surely not an illegitimate aim, it may well apply itself to the study of the consequences, for whatever is the ethical *bonum,* of economic structure and process. By the selection of the data which he investigates the economist may suggest by implication what in his judgment is the proper basis for ethical judgment, but provided he does not defend his selection on ethical grounds it is at least not obvious that he has offended the scientific proprieties.

That utility and welfare have been used in economics as ethical concepts may be conceded, but it does not follow that their use necessarily involves ethical judgment. When Knight cites the use of utility by economists in the justification of progressive taxation as illustrating the ethical nature of the concept,[1] he merely points out that it has been used for ethical purposes. It is not the acceptance of utility as an economic *datum,* but the acceptance of maximum satisfaction as the *summum bonum,* or as an important element therein, which serves some economists as the justification for progressive taxation. If there are utility theorists who hold with Knight that "men who know what they do want—and who have not sapped their vitality by unnatural living or too much of a certain kind of thinking—[do not] want their wants satisfied"[2] they might come to the same conclusion as other utility theorists with respect to the contribution of progressive taxation to maximum satisfaction of wants, but would use this conclusion as the basis for an ethical condemnation of progressive taxation. Whatever ethical implications the conclusions of the economist with respect to utilities may carry with them, these implications are for the ethicist or for the economist only in other than his professional capacity to act upon.

In any case, most welfare economists carefully disclaim any intention of pronouncing final ethical judgments.[3] For most of

[1] F. H. Knight, *American Economic Review Supplement* (March, 1921), p. 145.

[2] *Ibid.*, "Ethics and the Economic Interpretation," *Quarterly Journal of Economics* (May, 1922), p. 470.

[3] Fetter, however, asserts that it is necessary for welfare economics to distinguish between the "good" and the "bad" in acts of individual choice ("Value and the Larger Economics. II," *Journal of Political Economy* [December, 1923], p. 792).

them, it is true, there is no difference in kind between the economic welfare with which they attempt to deal and total or general welfare, but merely the limitation in the range of welfare problems considered and in the comprehensiveness of their analysis thereof which professional division of labor enforces upon them.[4] They are always ready to admit, however, the possibility of serious conflict between the economic and the non-economic utilities. They ordinarily go no farther toward ethical judgment than to claim the existence of a strong presumption that an increase in economic satisfactions or in economic welfare will contribute to total welfare.[5] If their welfare economics is in any degree an encroachment upon the field of ethics it is so as a casuistry in a partial and tentative ethics which admittedly does not take into account all the elements necessary for final ethical judgment.

UTILITY AS A WELFARE CONCEPT

The welfare economist, if he is of the utility school, generally defines and measures welfare in subjective terms of utility. But there pervades the utility economics a threefold ambiguity in the use of the term "utility," whose persistence is facilitated by the lingering traces of psychological hedonism in its analysis and by the lack of clearly-defined dividing lines in its organization between price problems and welfare problems. Utility is sometimes used to signify satisfaction, pleasure, happiness, or whatever the stuff of welfare is thought to be;[6] at other times to signify the capacity of goods to contribute to welfare, or to yield satisfactions.[7] In recent years there has been a tendency to confine its meaning to "capacity to satisfy desire" or "desiredness," and then to abandon it, because of its ambiguity, for the latter

[4] Cf. A. C. Pigou, *The Economics of Welfare* (London, 1924), pp. 10 ff.

[5] Cf., for example, Henry Sidgwick, *Principles of Political Economy* (London, 1883), pp. 518 ff.; A. C. Pigou, *op. cit.*, p. 20.

[6] Cf. Alfred Marshall, *Principles of Economics*, 6th ed., p. 93: "The total utility of a thing to anyone [that is, the total pleasure or other benefit it yields him]. . . . ."

[7] Cf. F. A. Fetter, *Economic Principles* (New York, 1915), pp. 25, 509.

term.[8] The time seems to be approaching when there will be a utility economics which carefully avoids employing the term which originally gave it its name!

Among welfare economists of the utility school it has been the general tendency to take satisfaction (in some cases, pleasure) as the unit of welfare. If the function of welfare economics is to contribute data which will serve the social philosopher or the statesman in the making of ultimate welfare judgments, this tendency leads, perhaps, to a hedonistic ethics. It is not necessarily entangled, however, in a hedonistic psychology, since if it avoids using price as a measure of satisfaction it need not commit itself to the existence of any close relationship between desire and satisfaction. The day seems definitely to have passed, however, when the philosophically-minded and the psychologically-sophisticated would give their support to an ethics written in terms of a pleasure element alone, or of any other single element. To say nothing of transcendentalists engaged in the pursuit of absolute values which derive their sanctions from other sources than current human desires and satisfactions, there are many who would place greater stress on the importance of the process of desire-fulfilment itself than on the gratifications or other states of consciousness which result from such fulfilment. Some emphasize the absence of unfulfilled desires, therefore, as more conducive to welfare than a great flow of satisfactions which still leaves their recipient discontented. The economist, whether naïvely or as a *modus operandi* while awaiting the solution by other disciplines of their own problems, has given scant attention to these difficulties.[9] Directly or indirectly influenced

[8] Cf. A. C. Pigou, *op. cit.*, p. 23. For this meaning of the word "utility," "capacity to excite or induce desire" would be preferable, as less ambiguous, than "capacity to satisfy desire."

[9] Exception must be made for F. H. Knight, who has probed these problems to their epistemological depths with a zeal, and with a capacity, for the subtleties of metaphysical inquiry each of which is surely unsurpassed among contemporary economists. His writings cannot be disregarded by anyone who wishes to cope seriously with the problem of the nature of the fundamental concepts of economics as a welfare discipline. At first inclined to limit economic inquiry to investigation

by the utilitarian tradition which has been so powerful and persistent in economics, he has seemed content to make his analyses in satisfaction terms, without evidencing much fear that a new revelation in philosophy or psychology, or old knowledge newly applied, would expose a lack of relevance of his analyses or his conclusions to human welfare. He is quite possibly wrong, but in the absence of clearer light he can but hope that there is a sufficient element of truth in his premises to give enough validity to his conclusions to justify—in a utilitarian sense—the effort expended in reaching them.

OBJECTIVE INDICIA OF WELFARE

Whatever may be the content of welfare, it is a matter of general agreement that it is subjective, internal, rather than objective, external, to man. But the difficulty, if not the complete

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of data external to man and of human behavior in its strictly objective manifestations, he later found this position untenable, and has reached the conclusion that economics, like even the physical sciences, though in greater degree, must deal with the metaphysical entities which lie behind the objective regularities which can be observed in the external world. He now not only concedes the legitimacy of economic investigation in terms of desire or of satisfaction, but he characterizes this as an intermediate or tentative stage preparing the way for an inquiry into the origin of the judgments upon which man builds a hierarchy of good-and-bad, higher-and-lower values, by which he subjects desires to an evaluation more fundamental than the merely quantitative standard of more-or-less satisfaction, or pleasure. I am disposed to accept his reasoning up to a certain point. Whether or no there is a hierarchy of absolute values which overlays the evaluation in terms of more-or-less satisfaction, we must for pragmatic reasons proceed as if for our purposes quantity of satisfaction were an adequate basis for welfare judgments. Knight would set us a task with which few of us are adequately equipped to grapple. We still have so far to go before we will have attained adequate control of the technique of the satisfaction-calculus that it seems unwise to attempt an even more difficult and more elusive type of subjective mensuration.

The progressive development of Knight's thinking on these and allied problems can be traced in the following of his writings: *Risk, Uncertainty, and Profit* (Boston, 1921), chap. iii; "Ethics and the Economic Interpretation," *Quarterly Journal of Economics*, May, 1922; "The Ethics of Competition," *ibid.*, August, 1923; "Relations between Economics and Ethics," *American Economic Review Supplement*, March, 1922; "Economic Psychology and the Value Problem," *Quarterly Journal of Economics*, May, 1925; "Fact and Metaphysics in Economic Psychology," *American Economic Review*, June, 1925.

impossibility, of measuring subjective quantities directly (and the doubt on the part of some whether qualitative differences between desires or between satisfactions do not so completely overlay quantitative differences as to make futile, even for the purposes of abstract speculation, the idea of a subjective calculus of welfare) has led to attempts to find objective indicia of welfare. Most notable has been the attempt to use price or exchange-value as the measure, or as an element in the measure, of welfare. Perhaps the chief contribution of the utility school to welfare economics has been the negative one of demonstrating the inadequacy at their best of such measures of welfare, because in many respects they conceal or are inapplicable to the very problems for whose solution they are intended to serve as instruments.

The inadequacies of price as a measure of welfare may be illustrated in connection with the problem of tracing the changes in welfare from one period in time to another for a given community.

1. If money income be proposed as a measure of the trend of welfare, there is the obvious objection that the monetary unit, from the point of view of the thing it specifically measures, objective exchange-value, is a yardstick which varies arbitrarily in its own length from time to time. If allowance is made, by reference to a perfect index number, for the year-to-year fluctuations in the exchange-value of the monetary unit, there is left virtually "real" or objective income, the flow of goods and services, as the measure of welfare. This is still inadequate, if for no other reasons than those adduced below.

2. The summation of miscellaneous goods and services must necessarily be accomplished in terms of relative price. Granting that a satisfactory method is devised to make provision for the constant shifting in relative values, prices measure the relative marginal significance for purchasers of the different goods, and welfare is a matter of total utilities (or total satisfactions), not marginal ones. This can readily be demonstrated by reference to the paradox of value that exchange value diminishes as total utility approaches its maximum.

3. Even if an objective measure were devised which would make allowance in terms of a common objective denominator for shifts in the relative total significance of different goods, this would still leave unsolved the problem presented by absolute changes throughout the range of goods in their total significance for the individuals comprising the community. If all prices remained the same, and every person's real income were doubled, an objective measure would indicate a doubling of welfare. But the diminishing-utility principle would establish a presumption that a doubling of objective income would less than double welfare.[10] Moreover, more goods may be needed if new evils are to be warded off[11] while maintaining the same flow of positive satisfactions. Or changes may occur in the total attitude of individuals to material income, a trend toward the simple life, or a greater appreciation of leisure, or, through the progress of education and physical well-being, an increase in the zest with which the material goods of life are enjoyed. A measure of welfare in terms of objective income will not reflect such changes in the slightest degree.

4. Changes in the relative distribution of income as between different classes will bring about changes in the amount of welfare, even though the aggregate real income of the community remains the same.[12] This is so generally accepted a corollary of the law of diminishing utility that further elaboration is unnecessary here.

5. Real income as a measure of welfare breaks down com-

[10] Thus Ricardo, lacking full possession of this principle, stated that if a man gets two sacks of corn where formerly he had gotten only one, "he gets, indeed, double the quantity of riches—double the quantity of utility—double the quantity of what Adam Smith calls value in use" (*Principles of Political Economy*, chap. xx, p. 265, in Gonner's edition).

[11] E.g., transportation costs resulting from greater distances between places of employment and available residential sites; medical expenses, because of greater prevalence of disease.

[12] Cf. Henry Sidgwick, *Principles of Political Economy*, p. 76: "If wealth were measured by its utility, 'amount of wealth' would partly be determined by the manner in which the wealth is distributed; and we could not say how much wealth there was in a country till we knew how it was shared among its inhabitants."

pletely in the case of the transfer of commodities from the "free goods" class to the "economic goods" class in consequence of greater scarcity of the commodities in question, and is in the same degree ill-adapted to indicate changes in welfare resulting from such increases in the available amounts of commodities as take them out of the class of "economic goods" and put them into the class of "free goods." An adequate welfare calculus must take into consideration the importance for welfare of free goods, and no calculus in terms of price can do this.

6. Real income as a measure of welfare is ill-adapted to deal with public goods, an increasingly important element in welfare. Estimates of the trend of real income either ignore the services rendered gratuitously to individuals by the government or, measuring them through the inclusion in the community income of the amounts paid as taxes, include them at their money costs, which may grossly exaggerate or grossly underestimate their welfare significance as compared to commodities measured in terms of their market values.

7. A calculus of welfare in terms of real income would reflect only the flow of welfare on the consumption side, and would leave out of the picture the satisfactions and the disutilities accruing from the process of production itself. An increase in real income resulting from an increase in the length of the working day may mean a decrease, rather than an increase, in human welfare. A constant flow of real income, if accompanied by a progressive diminution in the fatigues and pains of production and by an increase in the amount of satisfaction derived from the productive effort itself, as distinguished from its material products, will be consistent with a steady upward trend in welfare.

8. Even if price, or real income measured in terms of price, could be used as a measure of subjective quantities, what it would reflect would be the extent of desire for goods, and not the amount of satisfaction derived from their acquisition and consumption. A measure of desire can serve the purpose of a measure of satisfaction only if the two are quantitatively closely related, and there is abundant ground for scepticism in this re-

gard.[13] If welfare is a quantity of satisfaction, price, therefore, would not be an acceptable measure even if it did measure desire accurately.

The important contribution of the utility theory to welfare economics seems, up to the present, to have consisted in just such demonstrations of the inadequacy of price, and of all objective measures formulated in terms of price, as measures of welfare, and in exposition of the qualifications which must accordingly be made in conclusions with respect to welfare based on a price-calculus thereof.[14] The utility theorists, however, have often concentrated their attention on the single factor of inequality in the distribution of wealth, to the neglect of the other factors which militate against the acceptance of price as an adequate measure of welfare. In several notable instances economists who have formally accepted the utility analysis but were not well disposed toward a calculus in subjective terms have found irksome its questioning of the validity of objective measurement of welfare, and by minimizing, on one pretext or another, the degree of conflict between analysis in utility terms and analysis in objective terms, or by selecting for consideration only those problems in which the conflict is least sharp, or perhaps least apparent, have succeeded in reverting to measurement of welfare in terms of price, while retaining the language and the superficial appearance of subjective measurement.

The chief offender in this respect was Alfred Marshall. He disposed very neatly of inequality in the distribution of income as an objection to the measurement of welfare in price terms. "On the whole, however," says Marshall, "it happens that by far

[13] See *infra*.

[14] For early analyses in utility terms of the inadequacy of price as a measure of welfare, see especially F. Y. Edgeworth, *Mathematical Psychics* (London, 1881), *passim;* Henry Sidgwick, *Principles of Political Economy* (London, 1883), chap. iii; Philip Wicksteed, *Alphabet of Economic Science* (London, 1888), pp. 75 ff., 86 ff. Reference should be made also to two recent articles by F. Y. Edgeworth in which, with characteristic penetration and finesse of technique, he discusses the problem of objective indicia of welfare ("The Plurality of Index Numbers," *Economic Journal,* September, 1925, and "The Element of Probability in Index Numbers," *Journal of the Royal Statistical Society,* July, 1925).

the greater number of the events with which economics deals affect in about equal proportions all the different classes of society; so that if the money measures of the happiness caused by two events are equal, there is not in general any very great difference between the amounts of the happiness in the two cases."[15] This has been justly characterized as a "cavalier dismissal of the effect of 'differences of wealth' and 'differences in sensibility.' "[16]

Granted that there are some problems in connection with which the existence of inequality in incomes may be safely disregarded, it is nevertheless difficult to overestimate the extent to which the problem of inequality pervades and underlies the important problems to which economics has traditionally applied itself. It is necessary only to mention taxation, government expenditures, poor relief, immigration, land policy, and, above all, the problem of inequality itself to make clear that a calculus of welfare which abstracts from inequalities in the distribution of wealth and income is a *Hamlet* with Hamlet omitted from the cast.

The problems raised for welfare economics by the possibility of disparity between desire and satisfaction have been quite generally evaded by utility theorists in very much the same manner as Marshall evaded the problem of inequality. As has already been pointed out, utility theorists as a rule take welfare to mean satisfaction. Now price, if it measures any subjective quantity, measures desire, and is a measure of satisfaction only to the degree in which desire is an accurate reflection of satisfaction. But if there exists a welfare economics it is as an unsystematic and very much incidental appendage to price analysis, very imperfectly differentiated in technique and in objectives. A welfare economist who accepts satisfaction as the content of

[15] *Principles of Economics*, 6th ed., p. 131. For the same argument, in very much the same language, see Z. C. Dickinson, "The Relations of Recent Psychological Developments to Economic Theory," *Quarterly Journal of Economics* (May, 1919), p. 407.

[16] C. E. Persons, "Marginal Utility and Marginal Disutility as Ultimate Standards of Value," *Quarterly Journal of Economics* (August, 1913), p. 548.

welfare cannot, therefore, accept price as a measure of welfare unless he accepts desire as an accurate, or at least approximate, measure of satisfaction; but rejection of price as the measure of welfare involves an arduous reconstruction and reorganization of his thinking and of his economic "system." If appeal could be made to the hedonistic psychology, there would be no problem. Desire could be taken as a fairly accurate reflection of the satisfaction which would result from its fulfilment, and whatever was acceptable as a measure of desire would therefore be acceptable also as a measure of satisfaction. But the modern utility theorist disavows faith in the hedonistic psychology and in the complete rationality of human behavior. He nevertheless finds ingenious ways of proceeding with the discussion of desire quantities as if they were satisfaction quantities, while maintaining the appearance of logical consistency.

Pigou, for instance, concedes that the possibility of disparity between desire and satisfaction "obviously has great theoretical importance," but denies that it has great practical importance because "it is fair to suppose that most commodities, especially those of wide consumption that are required, as articles of food and clothing are, for direct personal use, will be wanted as a means to satisfaction and will, consequently, be desired with intensities proportioned to the satisfactions they are expected to yield."[17] This need be conceded only if expectations are never grossly mistaken, if the desires for "food and clothing" *are* simply desires for instruments for the satisfaction of primary physical needs whose serviceability for the purpose in view can be accurately judged by the ordinary purchaser,[18] and if desires,

[17] *Economics of Welfare*, p. 24. Cf. also, to much the same effect, Vilfredo Pareto, *Manuel D'Économie Politique*, Paris, 1909: "Quant à la substitution de la sensation de la consommation possible à la sensation de la consommation effective, si on considère des actions qui se répètent, et c'est ce que fait l'économie politique, ces deux sensations, en somme, se trouvent dans un rapport constant et tel que, sans erreur grave, la première peut remplacer la seconde."

[18] Cf. F. H. Knight, "Ethics and the Economic Interpretation," *Quarterly Journal of Economics* (May, 1922), pp. 463 ff. for an interpretation of desires for food, shelter, and clothing as desires for a whole set of cultural values rather than desires for mere nourishment, protection from the elements, etc.

even if originating in a careful calculation of the satisfaction-potentialities of commodities, may not persist after a change in circumstances has deprived them of their rational basis[19]—a rather formidable series of qualifications. And Marshall, after citing impulse, habit, morbidity, self-abnegation, mistaken expectations, and other possible causes of disparity between desire and satisfaction, concludes that as direct measurement of neither desire nor satisfaction is possible, it is necessary to fall back on price and make it serve, "with all its faults, both for the desires which prompt activities and for the satisfactions which result from them."[20] So also Dickinson cites, with apparent approval, Böhm-Bawerk's justification of the assumption of general harmony between desire and satisfaction on the ground that the causes of disparity "are usually such as cannot be reduced to any general principles, and the undue emphasis of them simply leads to agnosticism."[21]

To assume the lack of disparity between desire and satisfaction is arbitrarily and unwisely to limit the scope of welfare economics. The effects of ignorance on the part of the buyers of the degree of suitability of commodities offered for sale for their intended purposes, the practice of fraud, cunning, misrepresentation on the part of sellers—in fact, the whole problem of unfair methods in trade in so far as the unfairness is to the buyers—these are current evils which would not exist if the assumptions of Pigou and of Marshall were in accordance with the facts. There is a range of problems here, not to be dismissed without investigation as unimportant, and, without effort to find uni-

[19] Even as pronounced a hedonist as J. S. Mill saw the necessity of this qualification. Cf. his *System of Logic*, 8th ed., Bk. VI, chap. ii, p. 4: "As we proceed in the formation of habits and become accustomed to will a particular act or a particular course of conduct because it is pleasurable, we at last continue to will it without any reference to its being pleasurable. Although, from some change in us or in our circumstances, we have ceased to find any pleasure in the action, or perhaps to anticipate any pleasure as the consequence of it, we still continue to desire the action, and consequently to do it. In this manner it is that habits of hurtful excess continue to be practiced although they have ceased to be pleasurable."

[20] *Principles of Economics*, p. 92, note.

[21] Z. C. Dickinson, *op. cit.*, p. 401.

formities, as unsusceptible to scientific generalization. Is it not probable, for instance, that the modern development of aggressive salesmanship is tending to increase the disparity between desire and satisfaction, and that commodities pushed by intensive methods of selling are overdesired in comparison to the satisfactions they will yield, and play a disproportionate part in the ordinary consumer's budget as compared to the few commodities which are still permitted to make their own appeal? Is it not possible that there is a common underestimate of the contribution which governmental services make to individual welfare, resulting from the favorable advertising which private enterprise provides for its own products—and to the unfavorable advertising which it often spreads with respect to the products of government activity?

In one respect, however, the utility school has made systematic allowance for the disparity between desire and satisfaction, namely, where a substantial interval of time elapses between the experience of the desire and its satisfaction. With the exception of Pantaleoni, who, to preserve inviolate the purity of his hedonic economics, here maintains an elegant consistency,[22] the utility school uniformly recognizes a definite bias in favor of present satisfactions as against satisfactions distant in time. They make this bias, in conjunction with the actuarial allowances for the uncertain duration of life, the risk of changes in wants, and the chances of augmented income in the future, an integral part of their interest theory, as explaining the preference for present over future consumption.[23] The same procedure, if extended to other phases of disparity between desire and satisfaction, would quite conceivably afford a basis for equally serviceable generalizations.

Though we should conclude, in spite of the tendency even of

[22] *Pure Economics* (London, 1898), pp. 86 ff. Cf. also Wieser, *Natural Value* (London, 1893), pp. 16 ff.

[23] Pigou also makes some important applications of it to welfare problems, as establishing presumptions in favor of government measures for the conservation of exhaustible resources and against taxation which tends to fall heavily on capital (*op. cit.*, pp. 24 ff.).

utility theorists to revert to price as a measure of welfare, that price is not an adequate measure, it might be argued that we should, nevertheless, abandon the fruitless search for a practicable subjective measure and resort to some objective measure other than price. Such, for instance, seems to be the position of Wesley Mitchell: "In becoming consciously a science of human behavior, economics will lay less stress upon wealth and more stress upon welfare. . . . . At present welfare thus conceived is rather vague, but it is capable of being made objective and definite in reference to such matters as food, clothing, shelter, sanitation, education, fatigue, leisure."[24] True enough, if taken one at a time, and for one individual at a time, and at a particular moment of time, which, for most practical purposes, means not true at all. What if more or better shelter involves more fatigue? Or what if more food for Jones involves less food for Smith? Or what if more food for Jones now involves less food for Jones next year? An objective criterion of welfare cannot handle problems involving such conflicts of interest without equating them in terms of price. If this is done we are back to wealth as the measure of welfare. And the important and difficult problems of welfare are important and difficult precisely because they arise out of just such conflicts of interest.

WELFARE AS A LONG-RUN CONCEPT

A common shortcoming of the welfare economics of the utility school, and one, moreover, from which their classical predecessors were in large part free,[25] is their typically short-run approach to the problems of economic welfare. It is especially true of the Austrian school that they have restricted their discussion of the realization of utilities from the consumption of transitory goods to the immediately realizable utilities, to the neglect of the consequences for future welfare resulting from such consumption. This preoccupation with the immediate effects of consump-

[24] "The Prospects of Economics" in *The Trend of Economics* (R. G. Tugwell, editor), New York, 1924, p. 31.

[25] Cf., for example, the classical treatment of the effects of high standards of consumption on future population and wages.

tion could not be explained away by reference to the assumption of an omniscient economic man, competent adequately to take into account the entire flow of utilities, immediate and prospective, positive and negative, which would result from a given act of consumption, for, as has been shown, even the economic man was not presumed to give adequate weight to future utilities. The explanation probably is to be found in the adequacy for price-economics of a utility concept which expresses only immediate desires, and in the fear of the ethical entanglements which would apparently result from any departure from immediate intensity of desire as an all-sufficient test from the economic point of view of the comparative worth of goods.

The utility concept, however, if given so narrow an interpretation, cannot adequately serve the needs of a welfare calculus. Consider, for example, this explanation of the meaning of utility from a widely-used text:

> Anything that is capable of satisfying a human want is a good, and possesses utility. We need here to guard against a misunderstanding which the word "utility" might suggest. Utility is the power to satisfy wants, not the power to confer benefits. Cigars are as "useful" in the economic sense as bread or books, for all three satisfy wants. Economic wants may be serious, frivolous, or even positively pernicious, but the objects of these wants all alike possess utility in the economic sense.[26]

If the immediate satisfaction to an individual from the consumption of a given quantity of whiskey and a given quantity of ennobling literature be the same, but if the consumption of whiskey would result in future pains and frustrations for its consumer, whereas the acquisition and study of the good literature would contribute to a happy old age, the economist must, for welfare-calculus purposes, attribute greater utility or greater importance to the books than to the whiskey.[27]

[26] R. T. Ely, *Outlines of Economics* (1920), p. 105. Compare with Marshall's definition: "The total utility of a thing to anyone (that is, the total pleasure *or other benefit* it yields him) . . . ." (*Principles*, p. 93. Italics mine.)

[27] Fetter distinguishes between welfare "in an immediate or narrow sense," as an important factor in the determination of exchange values, and welfare "in a broader and truer sense . . . . the abiding condition of well-being" as the important quantity with which welfare economics must concern itself (*Economic*

INDIVIDUALISTIC VS. GROUP MEASUREMENT OF UTILITY

Most utility theorists may also justly be charged with failure to distinguish between an individualistic and a group concept of welfare, and to make adequate use of the latter. The "individualistic" concept of welfare may be taken to be that which bases its measurements of welfare solely in terms of the additions to, or the subtractions from, the welfare of the particular individuals, taken one at a time, who are directly affected by the institution or activity under investigation at the moment. A group concept of welfare, on the other hand, would endeavor to take into account the totality of influence, favorable or unfavorable, of such institution or activity on all who are affected thereby, directly or indirectly. It would thus take into account in connection with any particular price-transaction not merely those utilities which influence the determination of that price, but also those utilities, or disutilities, which accrue therefrom to persons who played no direct part in the transaction.

The laissez faire philosophy, with its fundamental assumption of an essential harmony between individual and group interests, covered up the need for a distinction between individual and group welfare, and was itself reinforced by the failure to test actual institutions in terms of such a distinction. But just as there have been few economists who were unqualified exponents of the laissez faire philosophy, so also there have been few economists who have concerned themselves with welfare problems as such without at times applying the group standard in their welfare appraisals. With but rare exceptions, however, welfare economists of the utility school confined their use of the group standard to problems which affected groups of persons *en masse* and could not possibly be handled in terms of solitary individuals. The entire range of economic activities which were wholly or mainly under the governance of the price system and of the principle of free contract, such as buying and selling, hiring and

Principles (1915), p. 509). So also McGoun's distinction between "higher" and "lower" desires ultimately rests on comparisons of the satisfactions derived *in the long run* from their realization (A. F. McGoun, "Higher and Lower Desires," *Quarterly Journal of Economics* (February, 1923), pp. 291 ff.).

firing, saving and spending, assumption and avoidance of risk, they appraised solely in terms of an individualistic analysis. They took it for granted that every freely contracted purchase-and-sale transaction brought gain to each of the two active participants, not only disregarding, as we have seen, the effects of ignorance and fraud on the part of one or the other of these participants, but overlooking the possibility that economic transactions may have vital bearing on the welfare of persons not directly concerned therewith, and failing to perceive that mere disparity in bargaining power might lead to exploitation of one party to a "free" contract by the other, even though both were honest, equally intelligent, and equally well-informed.[28]

Nevertheless, even when the utility theorists used an individualistic test of welfare, there was throughout their discussion the implication, either clearly expressed or readily to be inferred, that it was the welfare of the group which was important, and the welfare of individuals as comprising in their aggregate the group. And in dealing with matters of governmental policy, and especially in their support of specific departures from the laissez faire policy and in their treatment of the problems of government finance, they wholly abandoned the individualistic standard. These problems could not be handled at all in terms of the welfare of individuals taken singly, either because it was too obvious to be overlooked that an activity which would bring profit to some might injure others, or because these problems concerned benefits of an intangible and indivisible sort, accruing to the community as a whole and not imputable in measurable pro-

[28] Recognition of the importance of disparity in bargaining power as affecting the terms of the wage contract, and consequently the expediency of adherence to a policy of strict laissez faire, is lacking in even so late a work as W. S. Jevons, *The State in Relation to Labor*, London, 1887. See p. 42: "Laissez faire policy might still be maintained [i.e., wisely and justly] if everybody understood his interests." But even during the period of undisputed sway of the classical economics among the learned there was a current tendency in the business and political world even to exaggerate the extent to which superiority of financial resources could determine the outcome of commercial competition, to the disregard of community interests and of genuine advantages in productive efficiency (cf. my *Dumping: A Problem in International Trade*, p. 46).

portions to particular individuals. They here used a group standard of welfare, though there is little evidence in their writings that they were conscious of their change in standards as they proceeded from the discussion of problems of free contract to the treatment of the relationship between government and its citizens.[29]

UTILITY ANALYSIS AS CAPITALISTIC APOLOGETICS

In its early stages of development the utility analysis was made use of to explode the Marxian surplus-value theory. It was, consequently, charged by the Socialists with being merely a retreat by orthodox economics to a new line of defense made necessary by the successful Marxian attack on the classical argument for laissez faire.[30] In recent years it has again been attacked, and by learned economists who are themselves fully equipped with the traditions and the technique of the orthodox doctrines, as by its nature necessarily leading to a capitalistic apologetics. The grounds upon which this modern attack is based can be adequately indicated by citations from two of the foremost critics. "Political economy," writes J. M. Clark, "does not defend the existing system, but it selects for explanation the elements of co-operation in it, which are the elements that everybody approves of. The Austrian theory . . . . is relevant to these good elements in the existing system, and it is not *positively and constructively* relevant to any other side of the case."[31] "The study of utility seems to be oriented by the question: To what is value equal? rather than by the broader ques-

[29] Cf., however, F. von Wieser, *Natural Value* (London, 1893), pp. 228–42, for a discussion of the differences in standards actually operative as between the realm of free contract and the sphere of government activity, and for further elaboration of these differences, his "Theorie der gesellschaftlichen Wirtschaft," in *Grundriss der Sozialökonomik* (2d ed., Tubingen, 1924), Vol. I, Part II, pp. 292–302.

[30] Cf. H. M. Hyndman, *The Economics of Socialism* (London, 1896), chap. vii.

[31] "Economic Theory in an Era of Social Readjustment," *American Economic Review Supplement* (March, 1919), p. 284. Italics his.

tion: How does value function in relation to human wants?"[32] "When theory has studied the meaning of value in terms of utility, its very attitude and inquiry have presupposed an equilibrium between utilities, and thus have been oriented by a static point of view and static assumptions. The emancipated counterpart of this equilibrium inquiry is a study of the entire process of economic guidance, in which the utility theory appears as an interpretation of one phase only of guidance by one agency only, viz., the static or the hedonistic phase of guidance by individual initiative. For this is the only phase of guidance which falls within the requirements of a theory of equilibrium."[33] That economic theorist," says Hamilton, "is indeed an expert at logomachy who can use a nomenclature of 'utility,' 'disutility,' and 'productivity' and yet hedge the words about in such a way that he escapes the implication of making the system of prices as a whole represent such a use of limited resources in satisfying wants as to insure to society the greatest surplus of utility over disutility."[34]

Clark is obviously making a tacit assumption that utility analysis has been strictly confined within the limits of price economics, and he attributes to the utility school as a whole and as a logically inevitable outcome of its mode of analysis a restricted scope of inquiry and a type of conclusion therefrom which fairly characterizes only some of its exponents. Hamilton's assertion that only by word-juggling can utility analysis avoid leading to a defense of the status quo puts the cart before the horse, for it is only by word-juggling that utility theorists have avoided facing the serious questioning of the status quo which the utility

[32] "Economic Theory in an Era of Social Readjustment," *American Economic Review Supplement* (March, 1919), p. 289. This contrasts with Knight's complaint that utility tends to become an ethical concept, and to take us "from the realm of fact to that of what ought to be" ("Normal Price in Value and Distribution," *Quarterly Journal of Economics*, November, 1917, p. 67).

[33] "Economics and Modern Psychology," *Journal of Political Economy* (January, 1918), p. 3. Cf. Wieser, "Value in the Economy of the State," *Natural Value*, Bk. V.

[34] W. H. Hamilton, "The Place of Value Theory in Economics," *Journal of Political Economy* (April, 1918), p. 392.

analysis logically leads to. The utility analysis yields different products to different men. Most of its exponents may probably be rightly classed as conservative in their outlook on economic problems, and some of them have unquestionably used the utility theory to support their faith in the goodness of things as they are. Others of its exponents have been radicals, and have found the utility analysis a serviceable weapon in their assaults upon private property and the capitalistic organization of society.[85] It is altogether questionable that the utility school as a group has been more ardent in its defense of things as they are than its classical predecessors, and it seems apparent that utility analysis, if applied in the field of welfare economics, makes defense of laissez faire and eulogy of the capitalistic system more, rather than less, difficult than it would be to an economics written wholly in pecuniary terms.

I have already argued that much of what passes for utility theory is really objective price-theory presented in the purloined terminology of subjective analysis, and that it was by reversion in fact to price-calculus, while maintaining the semblance of subjective calculus, that many utility theorists managed to avoid dealing with the less pleasing aspects of private property and the unrestrained operation of the profit motive. But in spite of the generally conservative tendencies of the utility economists and the selective discrimination with which they chose the problems to be subjected to the utility analysis,[86] the utility theory seems on the whole to have shaken, rather than strengthened, their belief in the virtues of the existing economic organization.[87] It was not wholly without basis that J. S. Nicholson, in 1894, in his presidential address before the economics section of the British Association for the Advancement of Science, warned his audi-

[85] Cf. especially Adolphe Landry's *L'Utilité Sociale de la Propriété Individuelle*, Paris, 1901, where a vigorous attack on private property by means of price analysis is intensified in the second half of the book by the application of the utility analysis.

[86] Rather than, as Clark puts it, the selective character of the technique itself.

[87] Compare, for example, Edgeworth's *Mathematical Psychics*, or the concluding chapter of Wieser's *Natural Value*, or, in this country, Fetter's or Davenport's writings, with the typical surviving expositions of pre-utility economics.

ence that the new-fangled diminishing utility and maximum satisfaction doctrines were leading economists to socialism and away from the rock-ribbed individualism of the classical economics.[38] The utility theory is a mode of analysis, not a set of conclusions, and what conclusions will be reached by it will depend on the character and the fullness of the data to which it is applied and the skill and honesty with which it is used.[39] It would be trite, were it not for the extent to which the principle *Maledicti sunt qui ante nos nostra dixerunt* seems to pervade certain phases of recent American economic theorizing, to suggest the possibility that some, at least, of the older utility theorists applied the analysis honestly, and that intellectual curiosity occasionally got the best of social bias with the others.

PRACTICABILITY OF A SUBJECTIVE CALCULUS

The advocate of a subjective calculus of welfare encounters the objection that it is not possible to measure subjective quantities, whether they be desires, satisfactions, pleasures, or pains, except through their objective manifestations in price offers or other types of behavior. I believe the answer lies in the fact that we all do repeatedly measure desires and satisfactions as such, our own and those of other persons, and that much of our family relations, our contacts with our friends and neighbors, and the relations of government with its citizens are actually guided, whether well or ill, by such calculations. Such calculations of subjective quantities may never be exact, and may often be grossly inaccurate, but they can, and often must, be made in the absence of means to more precise measurement. Moreover, no one asks that economics abandon the pecuniary calculus and substitute therefor a purely subjective one. For many purposes the pecuniary calculus serves all needs. In any case, it is an institutional fact, an important force in human behavior and in

[38] *Report of Sixty-third Meeting* (London, 1894), pp. 843 ff.

[39] Cf. W. C. Mitchell "Wieser's Theory of Social Economics," *Political Science Quarterly* (March, 1917), p. 111: "[The utility theory] has been .... adopted as a substitute for Marxism by one set of socialists and decried as a covert defense of the established order by another set."

the guidance of economic activity, and must be fully reckoned with by the economist. But for many purposes the pecuniary calculus is a grossly imperfect instrument whose results require modification by calculations of subjective quantities before they can serve as an acceptable guide to action or to understanding.

The subjective type of measurement cannot, at least not as yet, yield absolute quantities as its product. The most it can attain is the discovery of more-and-less relationships, and even that with a very small degree of reliability. But there is a wide range of human activity in which only imperfect instruments are available with which to guide conduct toward perfection. Those who insist that welfare economics confine itself to measurement in terms of prices, because prices are data for statistical investigation, whereas the subjective conditions reflected by prices are not, have succumbed to an all-too-prevalent methodological fanatacism which prefers the accurate but superficial to the approximate but fundamental, and which makes adaptability to its special technique of investigation, rather than importance, the standard for the selection of problems and the delimitation of the scope of inquiry. Statistics is a tool, not an end. The imperfect measurement of variations in welfare may serve as a better guide to action than the perfect measurement of something which has something to do with welfare.

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TYPOTHETAE AND THE EIGHT-HOUR DAY

The eight-hour day was the goal set for American trade unions by the American Federation of Labor in its very inception and persistently maintained as an objective for the several national organizations. The International Typographical Union decided that it would make its campaign for nine hours in 1887 as having a better chance of success. It renewed its shorter-hour activities in 1890 on the same basis, and finally signed the Syracuse agreement for nine hours in 1898; but it was very generally known that the union looked upon this reduction in hours merely as a step toward the ultimate aim, the eight-hour day. The *Inland Printer* urged that the concession of the Syracuse agreement be made the basis for securing an agreement from the unions that they would abide by the nine-hour day for a definite period of time. No such clause was secured, although there is some evidence that there was an understanding on the part of Typographical Union officials that they would take no further action for a period of five years.[1]

This understanding did not preclude discussion of the subject, and at the union convention in 1901 a resolution was presented intending "to establish the universal eight-hour work day." The committee reported this resolution back to the convention without recommendation, stating that the time was inopportune for it, and it was laid on the table. Again in 1902 several resolutions were brought into the convention on the subject. This time a substitute resolution was adopted to the effect that the executive council should act as a committee, first for making plans looking toward the establishment of the eight-hour day, and second, for bringing the matter "before the National Typothetae, to the end that the eight-hour day be put

[1] *Inland Printer,* XXII (October, 1898), 55. Statement of Vice-President John W. Hays, *Minneapolis Journal,* November 11, 1905.

into operation without friction." Local unions were at this time instructed to make an effort to secure the eight-hour provision in making new contracts and to refuse to make contracts extending beyond October 1, 1905, which would require their members to work more than eight hours a day. They were advised to suggest that the reduction be made over a four-year period by taking fifteen minutes off the day each year.[2]

There were several reasons why the Typographical Union took up the eight-hour question so soon after getting the reduction to nine hours. Probably the foremost of these was the fact that its newspaper members were quietly securing shorter hours for themselves through the increasing use of the linotype, to such an extent that nearly half of the entire membership was already on the eight-hour schedule by 1904.[3] Naturally the other compositors also wanted the shorter day. The difference between the situation of the newspapers and the book and job shops was not seen by the workers. The important point for a newspaper is to have the largest possible amount of work in the composing room done in the last few hours before the paper goes to press. There is, therefore, not the close relationship between the usefulness of the workers and the length of the working day which is found in the job shops. The relation of labor cost to the value of product is also very different in the two kinds of shops. The newspaper sells advertising as well as printing, while the book-and-job printer is selling the printed product, and the latter must make his profit on labor and supplies and cannot afford to have idle machinery for an extra hour a day.

The success of an arbitration agreement between the International Typographical Union and the American Newspaper Publishers' Association in 1901 led to its renewal in 1902 for a five-year period during which the closed shop was assured to the union by the members of the association.[4] This meant that the newspaper compositors would be able to help their book and job

[2] Tracy, *op. cit.*, p. 711.

[3] Barnett, *op. cit.*, pp. 149–52, 155.

[4] Tracy, *op. cit.*, pp. 689, 772.

colleagues in case of difficulties, as they would be sure of their own jobs. The finances of the union were in good condition through the introduction in 1900 of the stamp system of collecting dues and the authorization in 1903 of a reserve fund which, though small, gave the officers ready money with which to act quickly in an emergency. Finally, there was the increase in membership of the union, which was, of course, closely related to all the other factors in the situation. From an international body composed in 1887 of 189 locals and 19,190 members, it had grown in 1902 to one of 559 locals and 38,364 members. The appeal of the eight-hour issue raised it to a peak, in 1905, of 690 locals and 46,734 members.[5] This matter of growth alone must have had an important influence in making the union feel ready to assert itself. It controlled in all probability well over half of the available compositors in the industry.[6]

The United Typothetae on its part was also ready for a test of strength. The growth of the Typographical Union and its plans for an eight-hour day were successful stimulants to the growth of the Typothetae and the success of its emergency fund, while the business prosperity of the years following 1898 made high dues seem less burdensome and altogether put the master-printers in a more assured and self-confident state of mind. Prompt acquiescence in plans of the Typographical Union was not to be expected in any case, and especially not an acquiescence in another reduction of working hours. The reduction to nine hours was the first shortening of hours by general agreement that had occurred in the industry, and this had happened as recently as November, 1899. The Pressmen's Union had agreed to a definite contract holding them to the nine-hour schedule until May 1, 1907. It did not seem to the employers to be reasonable that the Typographical Union should begin at once

[5] Barnett, *op. cit.*, pp. 81, 83, 376.

[6] The Typographical Union had in 1904, 46,165 members. According to the United States Census of Manufactures for that year, there were 219,000 wage-earners in the printing industry. On a rough estimate, compositors constitute a third of the total wage-earners, or for that year about 73,000. Thus the union probably had over 60 per cent of all compositors in the industry in that year.

to push the matter of a further reduction. They forgot, if they had ever clearly realized it, that the nine-hour agreement had not been so much a voluntary concession as a graceful yielding to the unions of what had already practically been secured. They attributed this new move of the Typographical Union to the bad effect on a union of giving it anything voluntarily, and felt that the psychological effect would be bad if they should even appear to be taking the union move seriously. When a letter announcing the intention of the union to begin an eight-hour campaign, and asking for a conference, was presented to the Typothetae convention in September, 1902, no attention whatever was paid to the matter. An inquiry from President Lynch as to the action of the convention brought him only the reply that the action of the Typographical Union in refusing to arbitrate the question of the union membership of foremen was considered by the United Typothetae as "fatal to further conference."[7]

Various minor irritations added themselves to the account. Legislation was secured through Typographical Union influence requiring the union label on city printing in Nashville, Kansas City, and Paterson, New Jersey, and was contested in the courts and declared invalid through Typothetae action. Similar legislation was being agitated by the unions in a number of other cities.[8] A peculiarly annoying strike occurred in the spring of 1903 in Atlanta. The Employing Printers' Club of Atlanta had an agreement with the various unions on the basis of which they asked the unions to withdraw their men from the office of an employer who refused to pay his fine when disciplined by the Club for price-cutting. The unions complied, and the employer in question appealed to the international presidents. The presidents of the binders' and pressmen's unions upheld the action of their locals, but President Lynch ordered the local compositors back to work. The Club retaliated by posting open-shop notices addressed to the Typographical Union, and a strike throughout

[7] *U. T. A. Proceedings* (1903), p. 48. The union had taken this stand in March, 1902.

[8] *Ibid.*, pp. 38–41.

their composing rooms resulted. This strike lasted several months and received a great deal of publicity.[9]

The Typographical Union convention in 1903 went ahead with the plans for the eight-hour day and made them more definite in several directions. A date was named, January 1, 1905, when local unions were to make the effort to secure the reduction in hours, and the goal was set as the eight-hour day rather than the forty-eight-hour week. This latter specification was stated as being "to the end that the spirit of the shorter work day be subserved and more work distributed among the book-and-job men not regularly employed."[10]

When the Typographical Union had actually set a date for its locals to make the effort to secure the eight-hour day the United Typothetae could no longer maintain its policy of ignoring the whole affair. In September, 1903, a month after the union convention, the Executive Committee of the United Typothetae promulgated the "Declaration of Policy." This document read as follows:

> The purpose of this declaration of policy is to explain to its members the precise position of the United Typothetae of America upon the several questions treated, and it is made, not with the view of antagonizing the cause of labor, but for the purpose of protecting and safeguarding the interests of the membership of the United Typothetae of America.
>
> I. The United Typothetae of America maintains the right of every firm comprised within its membership to conduct an "open" office, employing whomsoever such firm may choose, with due regard to existing contracts.
>
> II. The United Typothetae of America maintains the right of its members to employ whomsoever they see fit in the management of their respective offices.
>
> III. The United Typothetae of America maintains the right of every firm comprised within its membership to sell or to purchase from whomsoever they may see fit, without prejudice. It being understood the laws of demand and supply and of credit alone should govern transactions of buying and selling.

[9] *U. T. A. Proceedings* (1903), p. 57.

[10] *I. T. U. Proceedings* (1903), pp. 127, 171. The point involved in this distinction is that with the eight-hour day overtime pay begins at the end of the eight hours.

IV. The United Typothetae of America aims to secure uniform action of its members and of the local Typothetae upon subjects of common interest, and invites united and uniform action to resist any unwarranted or unjustifiable encroachments of labor organization upon the rights of employers. The United Typothetae of America, therefore, requests that when a demand is made by a labor union upon a local Typothetae, such local body should communicate with the National Secretary before conference is had in regard thereto.

V. The United Typothetae of America is opposed to any further reduction of the working time to less than fifty-four hours per week for day work. The local Typothetae are urged not to enter into any contract whatsoever, except upon the lines laid down in the sample contracts prepared by the U. T. A., and all contracts should, before execution, be submitted to the national organization for approval.

VI. The United Typothetae of America is opposed to any agreement between local Typothetae, or individual members thereof, and employees' unions for the control of trade or membership.

VII. The United Typothetae of America deprecates the use of the union label, and requests local Typothetae to urge their membership to refuse the use of said union label.[11]

There was nothing new in this statement of policy except the definite expression of an attitude on the question of the eight-hour day. The sections with reference to the union membership of foremen and the opposition to the union label had been adopted by previous conventions.[12] The section on agreements with unions for the control of trade reflected official opinion on the Atlanta case, which had shown the difficulties into which such agreements might lead. The United Typothetae had from time to time during its history passed open-shop resolutions. It had defined its position on this subject very recently by including an open-shop clause in the agreement with the pressmen, and by refusing to sign a similar agreement with the Typographical Union because that union would not assent to such a clause. It had not, however, taken an anti-union position. This is shown by the fact that at both the 1903 and 1904 conventions the president and other officers expressed satisfaction with the results of the agreement with the pressmen, and gave it

[11] *U. T. A. Proceedings* (1904), p. 18. The document was dated September 23, 1903.

[12] *Ibid.* (1899), p. 153; (1900), p. 215; (1903), p. 94.

as their opinion that every effort should be made to secure such agreements with the other unions.[13] At the 1903 convention the Chairman of the Executive Committee, in stating this opinion, added, "We have not found the officers of labor unions any less reasonable or any harder to deal with than the employers themselves."

Forces were at work, however, to put new color into a declaration of an open-shop attitude by the United Typothetae. Most important of these was the action of the Typographical Union. In 1899 it put into its general laws a closed-shop rule, and while it had been growing more and more insistent upon the observance of such a rule for years before that time, it now had the strength to make an issue of the matter and was beginning to do so. The action in 1902 in refusing an arbitration agreement with Typothetae because it contained an open-shop clause was a deliberate part of this campaign. The arbitration agreement concluded with the American Newspaper Publishers' Association in 1901 was definitely a closed-shop agreement, and this feature was maintained in the renewal of the agreement in 1902 for a five-year period.[14] The union began to take a special pride in the pursuit of this policy and to speak of it as a policy which they had originated and were now going far ahead of other international unions in developing.[15]

Outside influences had also their part to play. In 1902 the National Association of Manufacturers turned its attention to opposing labor organizations. In 1903 the Citizens Industrial Association was formed for the express purpose of opposing the closed union shop, the boycott, and the union label.[16] The attempt of the National Metal Trades Association to maintain an agreement with the unions in its field broke down in 1901 and left that association with a militant anti-union policy. A similar attempt by the National Founders' Association resulted in a

[13] *U. T. A. Proceedings* (1903), pp. 11, 69; (1904), pp. 10, 12, 18, 23.

[14] Tracy, *op. cit.*, pp. 647, 689.

[15] *Typographical Journal*, XXIII (November, 1903), 448.

[16] C. E. Bonnett, *Employers' Associations in the United States*, pp. 301, 370. *U. T. A. Proceedings* (1904), p. 42.

similar breakdown in 1904, and while that association continued to admit union-shop employers as members, it was active in opposition to union policies. It was a time when great corporations were turning their power against organized labor, and an "open-shop movement" was being conducted by employers outside of the trusts in a reaction against the rapid growth of trade-union control.[17] The closed shop and the open shop were much under discussion, and utterances on the subject had a correspondingly greater significance.

Thus there was at this time widespread interest in the subject of the open shop, agitation against unions from many sources, and prominence given to its closed-shop policy by the Typographical Union, and into this situation came the statement of the open-shop policy of Typothetae reaffirmed in all the special dignity and publicity of a Declaration of Policy. The result was a suspicion on the part of the Typographical Union that Typothetae was preparing to strike at its very existence under cover of opposition to the eight-hour day. This situation gave the union officers a strong additional argument to use, first in arousing enthusiasm among the rank and file for a fight, and again later on in justifying their action.[18]

It was true that there was a distinct anti-union tendency in some of the local Typothetae associations. A number of the locals joined the Citizens' Industrial Association, and the Typothetae of Chicago, Dayton, Kansas City, Milwaukee, St. Louis, and St. Paul were among the members of the conference which organized that Association.[19] The Chicago Typothetae began to put itself on an open-shop basis in the fall of 1903, when it broke off relations with the feeders' union on the open-shop issue, and it proceeded to discontinue relations with the various unions as each contract expired thereafter.[20] Such instances gave basis for the union suspicions.

[17] Bonnett, *op. cit.*, pp. 69, 75, 104. Commons and Associates, *History of Labour in the United States*, II, 526.

[18] Tracy, *op. cit.*, pp. 779, 849.

[19] *U. T. A. Proceedings* (1904), pp. 42–43.

[20] MS, Minutes of Chicago Typothetae, May 19, 1909.

When a strained situation arises between two national organizations the primary need of each, and of its individual members, is to know what is happening throughout the country. The Typographical Union began immediately after the first declaration of its eight-hour plans in 1902 to send out circular letters to the membership telling the plans, asking for information on local conditions, and then giving back that information in summarized form. When the officers of the United Typothetae began to realize that some move must be made on the question of the reduction in working hours, they found that they knew very little as to what was actually happening except in a few of the larger cities. They in turn sent out a request for information, sending it not only to their own members but to employing printers in any locality where there was a local Typographical Union. An astonishing response came back. Whereas usually the Typothetae secretary was able to get only a few answers to a questionnaire, or sometimes none at all, he received answers on this request from 436 cities out of 618 addressed. As was to be expected, opposition to the reduction in hours was widespread. There was a significant qualification, however, in the case of several cities where contracts with the local typographical unions had been renewed with a clause to the effect that "a shorter work day shall be subject to, and governed by, such agreement or settlement as may in future be arrived at through conference of the United Typothetae of America and the International Typographical Union."[21]

A number of Typothetae locals met union demands for the eight-hour day by the statement that questions of hours could not be decided locally, but were matters for adjudication between the two national organizations. Accordingly, President Lynch of the International Typographical Union once more addressed the United Typothetae recounting this general understanding and asking for conference during the next Typothetae convention. The Typothetae convention which was held at St. Louis in June, 1904, authorized such a conference. A committee

[21] *U. T. A. Proceedings* (1904), pp. 30–32.

from the Typothetae met with the Eight-Hour Committee of the union and asked the union representatives to make a proposition for the inauguration of the shorter work day for presentation to the Typothetae convention. The union committee declined to do this, stating that the main issue was the eight-hour day itself, and not any particular method or date for its introduction. They said they did not want the issue confused so that local associations could say that the United Typothetae had not declared itself against an eight-hour day, but only against a certain date for its initiation, and therefore, before taking any steps toward an agreement, they wanted a straight declaration from Typothetae as to whether or not it was unfavorable to a reduction in working hours. The Typothetae committee reported this to the convention, with the result that the following resolution was adopted by the convention and sent back to the union:[22]

WHEREAS, The International Typographical Union has asked the United Typothetae of America to declare its position upon the proposed eight-hour day, and

WHEREAS, Under existing conditions any attempt to reduce the hours of labor in the printing trade would be disastrous to the employer and employee alike, be it

Resolved, That the United Typothetae of America declares that it is opposed to any reduction of the fifty-four-hour week, and be it further

Resolved, That the United Typothetae of America will resist any attempt on the part of the International Typographical Union to reduce the present hours of labor.

Thus the first move in the conference game between the two national organizations was made by the union in such a way as to render practically impossible any position for the United Typothetae other than one of uncompromising and irritated opposition to the eight-hour day. The union officers were probably correct in their idea that this was the only way to secure a clear-cut issue, but it may be doubted whether they realized that its clearness could only be of one color. Any other answer than that made by the convention would have been giving away the whole Typothetae case in advance. This was a line of tactics

[22] *Ibid.*, pp. 100, 152. Tracy, *op. cit.*, pp. 776–77.

on the part of the union leaders which was frequently and severely criticized by the union itself throughout the strike which followed.[23] It was naturally interpreted by most of the employers as indicating the union leaders' desire to make a fight necessary, but it does not appear to have been that so much as a failure on their part to apprehend Typothetae's state of mind.

Another point on which the union leaders gave more thought to the problem of rallying their own rank and file than to the effect on the other side was that of setting a definite date for the eight-hour strike and setting it so long beforehand. It is true that this was an old-time traditional way of procedure which gave them a basis on which to bargain. But its disadvantages in this case much outweighed the advantages. Any chance of peaceful settlement of such a question involves not one or a few conferences between the interested parties, but many, many conferences. There must be time for the leaders on the side which is making concessions to decide what it is possible to do, and then much more time for them to educate their membership to see it that way. With a definite date set, the union leaders could postpone that date once or twice, but they could not continue very many times to arouse enthusiasm among the workers for a certain date and then set a much later date. They limited themselves as to the time within which they must bring the issue to open combat if they could not secure what they wanted. Moreover, in case it did come to combat, they were giving the enemy due notice and plenty of time to prepare.

The Typographical Union convention in August, 1904, following the Typothetae's June meeting, saw the need for more time than the previous date set for the reduction in hours had given. They postponed the date for the general strike to January 1, 1906, and they also expressed a desire for further conference with the Typothetae. The membership was now beginning to be really enthusiastic about the eight-hour day, and approved by a referendum both the new date and an assessment of one-half of 1 per cent on earnings beginning January 1, 1905.[24]

[23] *Inland Printer*, XLII (October, 1908), 76.

[24] Tracy, *op. cit.*, p. 811.

But another conference with the Typothetae was not so easy to secure. The union campaign for the eight-hour day had been having a very stimulating effect upon the growth of the Typothetae in certain directions, notably on the success of the emergency fund and on the development of open-shop sentiment. The fund began to pick up even before 1904, but at the St. Louis convention in that year the United Typothetae made it an essential part of its dues system. The dues were raised to one-half of 1 per cent monthly on the average mechanical payroll and 70 per cent of total dues was assigned to the fund, while general expenses were to be paid with the remaining 30 per cent. Moreover, the agitation that had been going on in Typothetae for centralized control at last bore fruit. The amendments to the constitution adopted at this convention almost made a new document of it. A section on powers was added, giving the organization power to legislate for its members on all subjects except wages, to assess them in addition to their dues either for general expenses or for the emergency fund, and to enforce its laws by fines and by the withdrawal of local charters upon failure to comply with the laws. The new constitution limited membership to master-printers not members of any labor organization.[25] It increased the Executive Committee from seven elective members to twelve, and made the secretary a non-elective officer appointed by the Executive Committee.[26]

The United Typothetae now had a constitution which would enable it to be a well-organized fighting unit if only the new regulations as to central control, higher dues, and compulsory contribution to the emergency fund did not scare away its members. But times were prosperous and the threat of union action imminent. Consequently the new plan went well.[27]

[25] This is a more drastic provision than appears on the surface. A large number of union-shop employers have previously been compositors and members of the union and maintain their membership in the union even after they become employers. Thus the provision put the choice to these men of dropping their union cards or else leaving the Typothetae.

[26] *U. T. A. Proceedings* (1904), pp. 105–12.

[27] With the usual secretiveness of war times, the records of membership of the U. T. A. were not printed either in 1905 or 1906. There is, however, the

The *American Printer* sent out a questionnaire of its own late in 1904 and received a unanimous response from prominent printers to the effect that a nine-hour day was certainly not too long, as they all worked longer hours than that themselves; that they had not found that their workers produced as much in nine hours as they had in ten when the last change in hours was made; that the open shop would be a benefit to both employers and employees; and that the increased cost of printing under an eight-hour day would have to be borne entirely by the employers, since the prices of printing could not possibly be advanced.[28] These were, indeed, the typical attitudes taken by the employers toward the reduction in hours. The attitude of the open shop was, as has been noted before, not necessarily anti-union, but rather the natural reaction of employers who are feeling the strength of the union pushing them in directions they do not want to go. The statements that the workers had produced proportionally less in the nine hours than under the preceding ten were never supported by any statistics, and were probably generalizations based upon pressroom experience where a difference in working time produces a more obvious difference in result. The other two points that the old hours were not too long, and that the increased cost could not be passed on to the customer were the same arguments that had been used against the nine-hour day. The former admits of no argument, unless on the basis of scientific investigation. Without such investigation it is merely a matter of opinion. As to the possibility of passing on the cost, successful printers were equally successful after the reduction to nine hours, and the union naturally thought that the same thing would result after the second change. It does not seem ever to have occurred to either side that the industry might try the eight-hour day in certain specially chosen plants, as an experiment, and judge by the results, or that the effects of

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statement of the Chairman of the Executive Committee at the convention in 1905 that "since adopting the new constitution we have increased our membership and rolled up an emergency fund greater than we last year thought possible" (*U. T. A. Proceedings* [1905], p. 12).

[28] *American Printer*, XXXIX (December, 1904), 269.

fatigue upon the workers could be measured and the question of hours of work studied in a scientific way. The union did not even attempt to set up arguments, scientific or otherwise. Its position was defined by President Lynch at the union convention in the summer of 1905, in words which were taken up by the union as its slogan for the battle.

> We do not want the eight-hour day by reason of charity or philanthropy. We do not want it in order that our physical or mental well-being may be improved. We refuse to abandon our eight-hour demand because we may, under present conditions, be more fortunately situated than other artisans. We want the eight-hour day because we are convinced that it suffices for the work there is to do, the work that is to be done, the demand of society for the product of the press. We propose to sell to the employer eight hours of the twenty-four, and we will do as we please with the remaining sixteen.[29]

Events moved rapidly in 1905. Approaching expiration of a number of important contracts with typographical unions, among them those of Chicago, Minneapolis, and St. Paul, brought the employers face to face with the seriousness of the situation. A big mass meeting was held in St. Paul by the master-printers of the Northwest, and this was followed by similar meetings in other parts of the country, to express their hostile attitude toward the eight-hour day.[30] Six of the larger typographical unions in the Middle West succeeded in May, 1905, in arranging a conference between their representatives and Typothetae leaders, and the attendance of the national officers on both sides was secured. Thus the union obtained the chance it had been seeking since the fiasco at St. Louis in the spring of 1904, to secure further discussion of the subject with the officers of the United Typothetae without making formal request to that body for a conference. Various plans were presented by the union leaders at this meeting for the gradual introduction of the eight-hour day, and one proposal of postponement to January 1, 1907, was offered. On the other hand, the Typothetae officers made one proposition only, to the effect that a nine-hour contract be signed for a period of three years, at the end of which

[29] Tracy, *op. cit.*, p. 811.

[30] *U. T. A. Proceedings* (1905), p. 7.

time the Typothetae would agree to take up and discuss the advisability of instituting the shorter work day.[31] This appears to have been intended as a concession on the part of the Typothetae, and was the only one made at any time during the controversy, but unfortunately its nature was not such as to make it an appealing proposition for the union leaders to present to their rank and file. The indefiniteness of the promise could hardly carry in their minds anything to offset the concession of three years' postponement. So the conference came to nothing.

This conference did, however, encourage the union officers to make one more trial. They invited President Ellis and Chairman Green of the Typothetae Executive Committee to address the Typographical Union convention, and the invitation was accepted. These Typothetae officers were cordially received by the convention, their remarks applauded, and an ovation given them at the close.[32] If President Ellis had made the three years' postponement appeal to this convention perhaps he could have convinced them. But to recede from the high position taken by the St. Louis resolution privately in a semi-official conference was one thing, and to do so as president of the United Typothetae addressing the convention of the International Typographical Union was another. He made a presentation of the case devoid of any hint of concession, with the emphasis on the necessity for the Typothetae to fight if the union should not give up its position. This was followed by another conference of committees from both sides, but without beneficial effect. It resulted only in a written request to the union committee that they recommend to their convention a complete reconsideration of the matter and withdrawal of the date of January 1, 1906, set for the inauguration of the eight-hour day. Naturally, such a request was useless.[33]

The predominant open-shop sentiment represented on this

[31] U T. A. circular letter, June 8, 1905. Tracy, *op. cit.*, p. 818.

[32] *American Pressman*, XLI (September, 1905), 57.

[33] *U. T. A. Proceedings* (1905), p. 44. Tracy, *op. cit.*, pp. 819, 835.

last Typothetae committee,[34] together with the fact that in Detroit, a strongly open-shop city, the employers had already forced a strike by putting non-union men to work in some of the shops, show that the open-shop element in Typothetae was in control, and account for the tone of these last negotiations. The strike in Chicago followed within two weeks, as also one in San Antonio, both brought about in the same way as the one in Detroit.[35] An appeal of the Typographical Union officers to the convention of the United Typothetae early in September, directly preceded by a final conference of committees from the opposing organizations, produced no results. On September 8 and 9 the union officers, realizing that Chicago and Detroit could not be left to take the brunt of the strike alone, called out all the local unions except where contracts were in effect, amounting to about eighty-eight in all, and involving, together with those already on strike, about three thousand men.[36]

Thus the strike was inaugurated three months before the date set by the union, but in a relatively small part of the total industry. Employers in the cities concerned found it much to their advantage, since it put them first in the market for non-union compositors. Typothetae to some extent realized that the real fight was still ahead, especially since the contract with the typographical union in New York would expire at the end of the year, just at the time planned by the union for the main strike. Offsetting this, however, was the support pledged by the Period-

[34] For membership see *U. T. A. Proceedings* (1905), p. 44. The Louisville representative said of himself that if he were to drop dead his friends need only lean down and whisper "open shop" in his ear and it would bring him to life (*U. T. A. Proceedings* [1904], p. 153). The Chicago representative was sent expressly to look after open-shop interests (Chicago Typothetae Minutes MSS, August 11, 1905). The Secretary of the U. T. A., who was also on the committee, was believed by the union to be pushing an open-shop fight in order to secure the approval and assistance of the National Association of Manufacturers (*Typographical Journal,* XXVII [December, 1905], 645). The one other member of the committee was a closed-shop employer from New York.

[35] The Detroit strike occurred August 10, the union convention August 14, 1905. *New York Journal,* December 29, 1905, p. 8. *Typographical Journal,* XXVII (September, 1905), 288. *Chicago Record-Herald,* April 28, 1907.

[36] *U. T. A. Proceedings* (1905), p. 70. Tracy, *op. cit.,* pp. 865–67.

ical Publishers' Association, a very important factor, since so large a percentage of the printing done in New York is work on periodicals.[87] Altogether, the employers felt that things were going well for them, and exulted a little prematurely over the situation. The *American Printer,* in November, 1905, announced victory for Typothetae and said that they were "well satisfied and would certainly go through with it again" to achieve such results.

The real storm broke with the beginning of the new year. It was now the union's turn to exult. They were well financed, with help from the American Federation of Labor as well as funds from an assessment of fifty cents per week per member beginning November 6, 1905, and increased to 10 per cent on earnings on January 1, 1906. They met with immediate and almost complete success with non-Typothetae employers,[88] and won public opinion to their side in many cases by conducting the strike entirely without violence. As seems most appropriate for highly skilled and intelligent workers, they made it a battle of wits. Many were the "non-union printers" for whom the employers were induced to pay railroad fares only to find that they had imported hod-carriers temporarily out of a job, or machinists' helpers. By using the quiet method of persuasion, by explaining the situation, with the inducement of free membership in the union or of paying transportation back home, the unions were often able to dispose of a whole train-load of strike-breakers before the train reached its destination. The New York Typothetae prepared for the strike, according to its own statement, by hiring a lot of guards to protect the non-union men, employing a corps of photographers to take pictures of pickets who might attack them, and engaging a number of lawyers to be on hand to prosecute the strikers who might resort to violence. "All the money expended in these directions has been wasted," they complained, "because of the new line of tactics used by

[87] *American Printer,* XLI (September, 1905), 81; (October, 1905), 150.

[88] *Ibid.,* XLII (April, 1906), 176. Stevens, *op. cit.,* p. 378.

Typographical Union Number 6."[39] The employers, not to be outdone in clever methods, saw to it that the unions expended considerable time, energy, and cash in "purchasing gold bricks."[40] The unusual character of the strike was widely commented on, and the absence of violence met with public approval and won a great deal of sympathy for the union.[41]

The main problem of the employers was to secure non-union workers and to keep any whom they did secure who were worth keeping. They tried to train young men and women to operate the machines, they set up several training schools, they had a central employment bureau; but all these methods could not accomplish much. Probably the most effective device used was a "Flying Squadron," made up partly of employers themselves, who answered calls from various cities, helped out the employers in desperate straits, and tried to form a nucleus for a non-union force in the plants.[42] The aid of the injunction was sought in a number of cases, and in New York and Chicago, as well as in several other cities, the Typothetae succeeded in securing injunctions against the union. The nature of the union methods of conducting the strike, however, did not admit of much use-

[39] Circular letter of New York Typothetae, quoted in *Typographical Journal,* XXVIII (February, 1906), 133.

[40] *Inland Printer,* XLII (October, 1908), 76.

[41] *American Printer,* XLI (February, 1906), 628. Also quotations from newspapers all over the country given in *Typographical Journal,* XXVIII (February, 1906), 133.

[42] *Boston Evening Transcript,* December 27, 1905; *U. T. A. Proceedings* (1906), pp. 12–16; *American Printer,* XLII (April, 1906), 176; *Chicago Examiner,* September 27, 1905, December 23, 1905. The schools were established in Kansas City, Chicago, Philadelphia, and New York, but as no mention of them is made in the *U. T. A. Proceedings* for 1907, even in reports on the subject of trade schools, it would appear that they did not last out the year. The above references in the *Transcript* and *Examiner* state that the pressure for non-union workers induced considerable "labor stealing" among the employers, with consequent bad feeling. Both Isaac H. Blanchard of New York and T. E. Donnelley of Chicago, who were leaders in the national, as well as in their local, contests, take exception to this statement. They believe that if such instances occurred they must have been very rare. The facts of the case probably were that the "stealing" was by Typothetae men, but not from each other. The *American Printer,* in the reference cited, says, "the small shops suffered most, since their workers went to Typothetae shops for the higher pay."

fulness for this device. Indeed, the Chicago injunction, by its severity and sweeping nature, was helpful to the union in securing public sympathy for the strikers.[43]

By June, 1906, the strike had settled down to a test of endurance between the Typographical Union and the United Typothetae. A communication from the union to the convention of the Typothetae in July, stating that the union was "ready for further conference with a view to adjustment of existing difficulties," was met by a statement from the convention that Typothetae had nothing on which to confer with the union.[44] As a matter of fact, Typothetae must have begun to realize that the union was gaining ground. The contest in New York was practically over. The periodical publishers had not been able to stand by their original intention of backing up the master-printers. One of the leading publishers had not been with the others in taking this stand, but had told them from the first that he could not afford it. A strike would cut off profits of more than $20,000 a month in order to save about $500 a month, the estimated cost of meeting the union demands. This publisher started a surrender movement. Others soon joined him in bringing pressure to bear upon the printing firms to yield to the union, and by July 1, 1906, the majority of the larger firms had left the Typothetae and were running on the eight-hour schedule with union workers. Among them was the plant belonging to the Secretary of the New York Typothetae. By the fall of 1907 all but two of the leading New York offices were union again. The influence of these occurrences in New York upon the rest of the

[43] *Chicago Tribune*, January 23, 1906. Resolution of Methodist ministers of Chicago against the injunction, *Chicago Examiner*, December 12, 1905; second resolution of same, *Chicago Tribune*, February 21, 1906; ministers of other churches, *Chicago Record-Herald*, March 5, 1906. Mr. T. E. Donnelley states that he does not recall that the injunction gained any sympathy for the union. These newspaper references, however, give actual texts of resolutions passed, and facts with regard to meetings held. Evidently there was no result from the meetings which brought them to the attention of the Chicago Typothetae.

[44] *U. T. A. Proceedings* (1906), p. 118.

country was to give encouragement to the union and to make the contest harder for employers in other cities.[45]

The United Typothetae exercised with severity the control over its membership given it by the conventions of 1904 and 1905, with the result that, as its members gradually found it impossible to hold out against the typographical unions, they were forced to resign from the Typothetae.[46] Significantly enough, Typothetae kept no records of membership for 1905 or 1906. In 1907 the membership list, as printed in the *Convention Proceedings,* numbered 802, and of these 181 were associate members, that is, supply houses and the like. In 1908 there were 729 on the list, with 187 of these listed as associate. This was a considerable drop from the membership of over 1,300 in 1904, amounting to a decrease of 46 per cent, even when associate members are included. When compared with the union loss from 1905 to 1907 of 9 per cent of its membership, and the fact that the union membership began to come back in 1908, it appears that the strike was considerably more disastrous to the employers' organization than to the union.[47]

On the score of organization expenditure, no fair comparison can be made. The special strike assessments of the International Typographical Union from November 1, 1905 to Feb-

[45] Statement of Isaac H. Blanchard, of New York. The two firms which held out against the union were the Blanchard Press and William Green, Inc. These two ran as non-union until January 1, 1914, when both, by contract, unionized their composing rooms. In this connection it should be noted that no two men in the industry have given more disinterested and valuable service, especially in industrial-relations work, or have had more cordial respect and confidence from the union, than Mr. Green and Mr. Blanchard.

[46] The revision of the constitution made in 1905 added the power "to suspend from membership any individual or local Typothetae taking action contrary to the expressed policy of the organization" (Article VI, Section 6). Action under this clause in the circumstances of the eight-hour strike amounted to expulsion. See *U. T. A. Proceedings* (1906), p. 20.

[47] U. T. A. membership lists in *Convention Proceedings* of the various years. The membership of the I. T. U. was 46,734 in 1905, its high point; 42,357 in 1907, and came back to 43,740 in 1908 (*Typographical Journal,* LX [Supplement, August, 1922]), 81.

ruary 29, 1908, amounted to $3,550,000.[48] On the side of the employers, however, it may be assumed that the organization expenditure was a minor matter. In any strike of long continuance, employers use their own resources in meeting the situation to an extent which cannot be computed. Such use of private funds, together with losses of employers from interrupted production and disorganization of working forces, would make up an imposing total if it could be known.

The United Typothetae was not ready to make peace with the Typographical Union in July, 1906, on any basis including consideration of the eight-hour day, but its attitude towards the eight-hour day had, nevertheless, undergone a change. This same Typothetae convention listened to an address by President Higgins, of the International Printing Pressmen and Assistants' Union, on the subject of the renewal of the arbitration agreement with that union, appointed a committee to confer with the pressmen, and authorized a special convention which met February 2, 1907, and ratified the new agreement; and the new agreement contained the concession of the eight-hour day.[49] Typothetae's Executive Committee had come to the conclusion that it would not be backed up by the membership in undertaking to dispute the eight-hour day with the pressmen. This was not only due to the fact that many of the leaders now found themselves with resources almost exhausted by the struggle with the typographical unions, but also because of a general friendly feeling toward the pressmen, since they had stood by the employers during the strike.[50]

Whatever the relative weight of the eight-hour issue and that of the open shop may have been to the United Typothetae when the eight-hour strike began, it was clearly the open shop which was now their greater interest. They were willing to concede the eight-hour day to the pressmen, although they did modify the concession by a postponement from February, 1907, to

[48] Barnett, *op. cit.*, p. 80.

[49] *U. T. A. Proceedings* (1906), p. 81; 1907, p. 4; 1905, p. 17.

[50] Statement of Mr. T. E. Donnelley March 30, 1925.

January, 1909, for its enforcement. But they insisted upon keeping in the agreement its open-shop clause, i.e., "the employer fulfils all the terms of this contract by paying the scale of wages and living up to the shop practices as settled by the Committee, regardless of his employees' union affiliations." This was an interesting development in the labor policy of Typothetae. The agreement with the pressmen, whereby Typothetae members had been free from danger of pressroom trouble up to May 1, 1907, had been scrupulously observed by the members of that union, and had been one of the greatest assets to Typothetae during the strike. As has already been noted, the attitude of the employers toward the pressmen's union was consequently very friendly, and there is evidence that they gave the preference to union pressmen during this period and took little or no advantage of the open-shop clause.[51] Typothetae thus had favored the one union while fighting the other. At the same time they had developed in their own ranks such a pronounced open-shop attitude that when the time arrived to give the favored union recognition of its good conduct, and at the same time protect themselves for a further period, they could concede the eight-hour day, over which all the trouble had occurred, more easily than to give up an acknowledgement of the open shop.

President Higgins of the Pressmen's Union and his committee were willing to take the real concession on hours in exchange for the nominal one of the open-shop clause, and they signed the agreement. But it was a situation ripe for use by a politician, and a very astute politician was at hand. At the next convention of the pressmen, beginning June 17, 1907, George L. Berry

[51] *Inland Printer*, XXXIX (June, 1907), 373. The claim was made by the *American Pressman*, the official organ of the International Pressmen's Union, that the reason for the success of this agreement was a secret understanding that employers would never replace a union pressman by a non-union one. Mr. T. E. Donnelley, who was a member of the committee that negotiated the agreement, states definitely that there was no such secret understanding, and that the success of the agreement was largely due to the attitude of the pressmen who were not aggressive but were satisfied if their wages and working conditions were up to standard (letter, March 30, 1925).

made a victorious campaign for the presidency of that union on the platform of "the closed shop and an immediate eight-hour day." The convention decided to ratify the agreement only in case the United Typothetae would consent to strike out the open-shop clause. If it would not so consent, the union was to proceed to take a referendum of its members on the question of the immediate inauguration of the eight-hour day. This action of the union convention was taken on the ground that their committee had not been authorized to make an open-shop agreement. The committee had therefore exceeded its instructions, and the contract was still subject to ratification by the convention of the union.

The United Typothetae, when confronted with this action, took the position that the committee of the union had represented itself as having full power to complete the agreement, that the agreement had been ratified by a special convention of the United Typothetae, and was therefore held as binding by that body and not subject to change. Typothetae proceeded to secure an injunction in the federal court of Cincinnati restraining the officers of the union from calling strikes on either the eight-hour or the closed-shop issue, and from taking the proposed referendum. This injunction was only partially effective, since it did not prevent the union members from striking without the call from their officers. When it came to a final hearing it was vacated by the judge, who decided that the union convention was not bound by the action of its committee, and that the agreement, to be binding, should have been ratified by that convention.[52]

The net result of it all was that the pressmen made rapid progress in securing the eight-hour day. With no contract to restrain them, they were able to reap to the full the advantage af-

[52] *U. T. A. Proceedings* (1907), p. 53, Appendix; 1908, p. 57. Tracy, *op. cit.*, pp. 899, 914. *American Printer*, XLIII (February, 1907), 692; XLIV (July, 1907), 569; XLV (November, 1907), 332; XLV (January, 1908), 539, 693; XLVI (March, 1908), 73. *Inland Printer*, XL (November, 1907), 210; XL (December, 1907), 370. *Record No. 1810, United States Court of Appeals, Sixth Circuit*, p. 699.

forded them by the results of the battle of the Typographical Union. It was difficult for the employers to run their composing rooms on a schedule reduced to eight hours a day and not to make the same concession to the other departments. Thus in many cases the pressmen did not need to call a strike to get the eight hours, and even the bookbinders, whose union was financially very weak, profited by the situation. The stereotypers and photo-engravers, both constituting small groups of highly skilled workers, had also secured the shorter work day by this time. Except in Typothetae shops the printing trade was prevailingly on the eight-hour day, or the forty-eight hour week, by 1908. This fact was given formal recognition by the Executive Committee of the United Typothetae when, on February 28, 1908, it approved a revision of the "Declaration of Policy" which entirely omitted the paragraph expressing opposition to "any further reduction of the working time to less than fifty-four hours per week."[53] Appropriately enough, this action coincided, with only a difference of one day, with the final withdrawal of the strike assessment on February 29, 1908, by the International Typographical Union.

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[53] *U. T. A. Proceedings* (1908), p. 45.

BOOK REVIEWS AND NOTICES

American Agriculture and the European Market. By E. G. NOURSE. New York: McGraw Hill Book Co., 1924. Pp. xvii+333; charts, 47. $2.50.

This book is one of a series of publications on current economic problems being issued by the Institute of Economics at Washington, D. C. In the words of the Director of the Institute, "It attacks merely the one question: What is the real condition confronting American agriculture so far as the European market is concerned?" The thesis of the work, as determined by the result of the author's investigations, is that American agriculture can no longer look to the European market as an important outlet for its products and a means of bringing back its lost prosperity. It does not attempt to meet the problem as to what alternative is available, but merely contents itself with pointing out that prosperity, for American agriculture, cannot be found in the direction of European rehabilitation and restored purchasing power.

In the first part of the work, entitled "How the Present Situation Developed," the author presents a swift survey of the history of American agriculture for the purpose of showing how its development has depended upon the European market and how natural it is to turn to that source for relief in the present crisis. He shows that for more than a hundred years the European market was a prime factor in the growth of our agricultural industry; that particularly during the last third of the nineteenth century our agricultural development tended to outrun even the rapidly expanding demand abroad, and that only with the beginning of the present century did our agriculture become adjusted to demand sufficiently to give us real agricultural prosperity. About this time there began a new epoch in the relation of our agriculture to the European market, in that domestic demands for our products began to cut into our exports sufficiently to make us a relatively less important source of food and raw materials for a rapidly expanding European industry. The author is convinced that this change is significant enough to mark the beginning of the end of European dominance in the market for our American farm products.

The war expanded our agricultural production to a marked de-

gree by the creation of an abnormal and purely temporary market situation. Also it hastened the processes already under way by which Europe was being removed from its former position as an important market outlet for our agricultural products. With the crisis of 1920 and the depression following it the farmer was made painfully aware of the maladjustment between his production and his market.

Following this excellent survey of the historical development of our agriculture and of the situation in which it found itself as the result of the world-war, the author in the second part of the book, entitled "The Problem in 1924 and Thereafter," addresses himself to the task of appraising the situation in Europe as its various elements are likely to affect the rehabilitation of American agriculture in the next few years. He first enumerates the factors determining Europe's purchasing power and reviews the various means of purchase commonly used in international trade, such as metallic money, instruments of credit, commodities, and the sale of corporate securities, discussing these with reference to the various western European countries to which we have been wont to look for a market for our agricultural goods. He decides that in the case of each one of these means of purchase all of these European countries, with the possible exception of Great Britain, are decidedly weak.

He next attacks the question of "what determines where Europe will buy," and in this connection discusses the various important agricultural countries of the world from the point of view of their competitive ability, and of the political and financial relations existing between these countries and the nations of western Europe as these relations may affect trade. His net conclusion is that not only are we likely to be at a disadvantage as competitors with such countries as Argentina, Canada, India, Australia, New Zealand, and Russia because of our higher costs, but that the close political and financial relations existing between western Europe and these sources of food and raw materials will operate to direct European demand toward these sources of supply, to the detriment of the American farmer.

In the opinion of the reviewer, this estimate of the future is the least convincing portion of this very interesting and important work. One can concur, with but few reservations, in the author's closing dictum: "For American agriculture to plan her future building on the foundation of an expected revival and growth of the European market would, therefore, mean building on quicksand." Yet there seems to be a tendency to overdraw on the available evidence in the direction of

a too extremely pessimistic view. Specifically, in discussing the low purchasing power of European countries, the author seems to overlook the important economic fact that the total purchasing power of a country is the aggregate of the individual purchasing power of its people; that these private increments of purchasing power are widely differentiated; that in spite of an impoverished general condition, a considerable portion of the population are relatively well-to-do; that this purchasing power, however limited, will be selectively employed in the direction of securing for its possessors the thing of which they are most urgently in need. For example, the German people, with their inability to produce a sufficient amount of fats, and their decided preference for animal, rather than vegetable, fats, will continue to buy American lard in large quantities even though it means a sacrifice of other less desired purchases.

Again, it would seem that he overestimates the seriousness of agricultural competition from other countries. It is not reasonable to suppose that our farmers will shortly become marginal or submarginal, so far as the world-market is concerned. The truth is that our farmers show a wide range of efficiency, and hence produce at a wide range of costs. The essential elements which will determine whether we can produce under conditions which will enable us to compete successfully in the world-market are, first, the productive potentialities of our natural resources, and second, the efficiency of the human element in our agriculture. The reviewer finds it hard to attach the importance which the author does to the fact that our agricultural resources have become highly capitalized. This is the least important element in whatever significance may attach to so-called production costs, and appears as an effect of high prices, and not a cause. It would seem that the more important consideration as to whether we shall continue to ship large quantities of agricultural commodities to Europe is not whether we can compete with other producers, but whether our home market will develop to a point which will make us independent of foreign outlet in such important commodities as breadgrains and meat. It would seem, also, that the author has overestimated the productive potentialities of the undeveloped lands of the world, and has underestimated the amount of capital and the length of time necessary to bring them to producing in sufficient volume to work the effects which he forecasts.

The reviewer, in pointing out what seem to be certain defects in the author's argument, does not wish to seem to regard these defects

as vitiating the main thesis of the book. It is a distinct contribution in a field where such analyses are greatly needed, and it is prepared in a way which makes it intensely interesting reading.

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International Exchange, Normal and Abnormal. By THOMAS YORK. New York: Ronald Press Co., 1923. Pp. vi+600. $5.00.

The book is divided into four parts: "Principles of Normal Exchange," "Practical Exchange Operations," "Abnormal Exchange," and "Silver Exchange."

The first part follows the general plan of the author's smaller book on foreign exchange, published about three years earlier. The method of treatment in this theoretical part of the book is to assume that two countries, the United States and England, are on an effective gold-standard basis. The troy ounce of 480 grains is substituted for the monetary units of the two countries concerned. In this way the author hopes, first to break down the "prevalent notion that the phenomenon of foreign exchange is due to the difference between monetary units of the two countries"; and second, to force the reader to remember that monetary units are simply units of weight. The foreign-exchange banker is dispensed with, and direct relations between the principals or their agents in the foreign city are assumed.

The hypothetical method of treatment fails in its chief purpose. Instead of simplifying the discussion, the unreality of the treatment renders it much more difficult. Further, an overemphasis is placed upon the principles of foreign exchange under the gold standard. Not a nation in the world, including the United States, maintained an effective gold standard throughout the period of the war. The gold standard has never been universal, and its complete restoration, where formerly used, will doubtless be long delayed.

The author correctly states that demand, or sight exchange, is most commonly employed, and hence is the most important type. Nevertheless six chapters on the principles of spot and future cable exchange precede any treatment of the more familiar type of foreign-exchange transaction. This seems especially unwarranted in view of the further fact that most readers are more accustomed to domestic payments made with written instruments than with telegraphic trans-

fers of money. The presentation of principles by the hypothetical method assumed may be facilitated by this order of treatment, since cable transfers make possible simultaneous delivery of gold in the two countries involved. To the reader unfamiliar with the intricacies of foreign exchange, however, the cable transfer is too complicated a form of remittance to be used as an introduction to the subject.

The author discontinues the hypothetical assumptions in Part II, and deals with practical exchange operations. Three chapters discuss the place of various dealers in the American exchange market. Trading in exchange, financing of foreign trade by various methods, traveler's credits, and international security dealings are successively treated. This portion of the book is much more satisfactory than the "Principles." The author's familiarity with the New York market and the practice prevailing in the American banks is evident. The absence of illustrative forms will somewhat handicap the general reader, as well as make the book less readily usable in many classrooms.

In the first chapter of Part III, dealing with abnormal exchange, the assumption is made that one of the two countries is on an effective gold standard, while the other has a depreciated paper standard but maintains a gold market and imposes no export restrictions. This situation is illustrated by the United States from 1862 to 1879. A later chapter deals with exchange between two depreciated-standard countries. Here the author uses sterling-franc exchange and assumes free gold exportation is permitted by both countries and that there is an active gold market in Paris as well as in London. The fact that Paris had no gold market, and that both countries maintained an embargo on gold exports makes this entirely unreal. Nor does the treatment in subsequent chapters provide an adequate explanation of the principles of abnormal exchange under conditions which have actually obtained during the past decade.

The author's failure to offer a complete explanation of depreciated exchanges is due, apparently, to his underlying hypothesis that money is always a commodity, and that a paper standard is really a "future" gold standard in which "currency is equivalent to the face amount of gold deliverable at some indefinite future time." The mere fact that history is replete with examples wherein the face amount has never been, or never will be, delivered does not appear to disturb him.

Among the causes of the price advance, scarcity of commodities is given first place. Currency inflation is held to be a result of capital depletion, and not the cause of the price rise. The remedy for recent

currency depreciation the author believes to lie in repairing the ravages of the war. He argues that in France, Italy, or other countries the revaluation of the monetary unit could be successful only under stable economic and political conditions which would assure gold redemption on the new basis. This is obviously the case, but it does not follow that the solution will eventually be deflation and a complete restoration of the gold standard on the pre-war basis. Such a solution, in the judgment of the reviewer, will not, and should not, be undertaken.

In discussing foreign trade under abnormal exchange conditions the author takes the position that "the relation of the general price-levels of the two countries does not influence the rate of exchange so much as it is influenced by the rate." This reverses the cause-and-effect relationship as set forth in the widely accepted purchasing-power parity doctrine. He does, however, recognize an intersection of causes, and he also shows that it is not the abnormality of exchange rates, but their wide fluctuations, that is significant in disturbing international commerce.

Part IV, on silver exchanges, treats only of exchange with China. A full explanation of the normal operations of a gold-silver exchange is given. The phenomenal rise in the price of silver during the war is mentioned, but the factors causing the rise and the measures taken to meet the situation are not fully discussed. A more serious ommission is the failure to discuss anywhere in the book the gold-exchange standard and the disturbing effect of the rise in the price of silver upon this plan for stabilizing exchange.

While Mr. York's book contains much valuable material on practical exchange operations, it does not offer a tenable theory of exchange rates or a satisfactory discussion of the underlying laws of exchange.

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Common Stocks as Long Term Investments. By EDGAR LAWRENCE SMITH. New York: The Macmillan Co., 1924. Pp. ix+129. $1.50.

It has been the purpose of the author to bring about a clearer understanding of the differing attributes of bonds and common stocks, in order to help determine the relative proportion of each of the two

classes of securities which will best serve the investment requirements of each investor. He discusses the tendency which has existed among investors, in the past, to regard common stocks as a medium for speculation, and bonds as the best medium for long-term investment. In order to determine, if possible, whether the investment market in general has overlooked the possibilities of common stocks, Mr. Smith has made a group of statistical studies.

Common stocks have been compared with bonds, as to investment value, for several different periods of varying lengths. The periods for which comparisons were made were: 1901–22, 1866–99, 1866–85, 1892–1911, 1906–22. The first will serve as an illustration of the author's method of approach to the problem. In this case it is assumed that ten thousand dollars is invested in ten common stocks, selected at random, and the return, including all dividends, rights, etc., plus selling price of the securities at the end of the period, is compared to the return on the same amount if it had been invested in high-grade bonds at the beginning of the period. Other tests of a more specialized nature were also made for particular lines of business.

Mr. Smith concludes from his studies that a well-diversified list of common stocks offers a form of long-term investment superior to any other class of security. He bases his conclusion partly upon the fact that his studies show a greater income return nearly every year than the current rate of interest on commercial paper, and partly upon the increase in capital value. The increase in capital value, he thinks, is due to the custom that corporations have of reinvesting a part of their earnings each year in the business instead of paying out the entire amount in dividends, in this way increasing the value of the investment at a rate corresponding to the compound interest curve. In fact, he shows that the increase in principal value of the stocks selected follows a curve very similar to the 2½ per cent compound-interest curve.

While the writer of this review is in sympathy with Mr. Smith's contention that the investment possibilities of common stocks, as compared to other forms of securities, have been overlooked, he is inclined to question the advisability of accepting Mr. Smith's conclusions upon the basis of the studies he has made. Among the reasons for doubt, until further work has been done, might be mentioned the following:

1. Not enough cases were taken. Only one group, of ten stocks, was used for each test. A much more thorough test would have been

to compare all listed common stocks with all listed bonds, or at any rate to have tried a number of combinations instead of only one.

2. Comparison was made between a representative list of common stocks and current interest rates for high-grade commercial paper, not between stocks and bonds, excepting two cases in the Appendix. In one of these, where the bonds were chosen with regard to yield as well as safety, bonds proved a more profitable investment than stocks. This would seem to indicate that if the list of bonds had been selected not only with the aim in view of getting a high degree of safety, but also with some attention to the rate of return, the results might have been quite different.

3. Diversification is impossible for many investors. As Mr. Smith suggests, there is probably a place in the financial world for an institution which will furnish the advantages of diversification to the small investor.

4. Purchases were made in one selected year and sales in another selected year. This method yields only a small amount of data. If more purchase and sales times had been assumed, a broader basis would have been afforded for generalization.

It is not intended by these criticisms, however, to depreciate the results shown. Most of the criticisms merely suggest that further work should be done. It was to be expected that a pioneer would leave a few partly worked fields. The little volume represents, as it is, an immense expenditure of time and energy, and will be welcomed by all students of investment problems.

JAMES ROY JACKSON

UNIVERSITY OF CHICAGO

Farmers and Workers in American Politics. By STUART A. RICE. (Columbia University Studies in History, Economics and Public Law. Vol. CXIII, No. 2.) New York: Longmans, Green & Co., 1924. Pp. 231. $2.50.

This book analyzes the mutuality of interests and the facts of actual political alliance between farmers and industrial workers.

The author begins with a social-psychological discussion of the basis of group formations, of unrest in the two major political parties, and of the conditions of emergence of a political bloc or party. There follows examination of interests, economic and cultural, which might

lead to a farmer, or labor, or farmer-labor bloc. The study brings out the presence or absence of relationship between insurgency and such economic factors as ownership of property, indebtedness, income, investment and speculation, and taxes. It discusses the effect of the material economic environment upon the attitudes and habits of thought of both groups, explaining thus, for example, the typically entrepreneur and individualistic spirit of the farmer.

Careful analysis is made of the basis of alliance or of antagonism between farmers and laborers. The one is thinking of the price, the other of the wage-bargain. Differences of rural and urban outlook, of homogeneity and heterogeneity of nationality, of marital status, and of age are brought out. While giving due weight to similarity of interest in attack upon the middleman's profits, the writer stresses the fact that there is a triangular situation here in which, under varying circumstances, any two might ally against the third economic factor.

Interesting material is given concerning forces which seem to arouse group or bloc formation. In the case of the farmers the author has found them to be moral issues, while in the case of labor he considers them predominantly economic. From the standpoint of the ideals of the farmer, perhaps, and certainly of the labor movement, this generalization is too sweeping. For the purpose of showing possible alignment of the rank and file in an immediate political situation, however, it has value.

The author is wise in avoidance of prediction. Instead he gives us basic material on similarity or dissimilarity of interests which should help the student of affairs to evaluate and interpret negotiations between these two groups as conditions give rise to them. The style is smooth and readable. Careful statistical analysis gives soundness to the whole study. The author is rightly cautious about drawing conclusions based upon probabilities when the data are relatively few.

The whole study gives pause to the glib assumption of wide similarity of interests of the two groups and to the belief that similarity will of necessity express itself in the formation of a new political party. It shows the group, the bloc, forcing its needs or program upon the attention of the major parties. Within the inherited lines of the old parties it shows us certain foci of interest forming, dissolving, and reforming. This seems a much more accurate description of actual occurrence than is the suggested tendency to complete cleavage and the formation of a stable, new party. As an aid in making us under-

stand this process more clearly and take greater cognizance of it in our economic and political thinking and programs this study makes a sound contribution.

MOLLIE RAY CARROLL

GOUCHER COLLEGE

Miners' Wages and the Cost of Coal. By ISADOR LUBIN. WITH THE AID OF THE COUNCIL AND STAFF OF THE INSTITUTE OF ECONOMICS. New York: McGraw-Hill Book Co., 1924. Pp. xiv+313. $2.50.

Bituminous coal is a sprawling industry and its wage rates vary bewilderingly from mine to mine, from seam to seam, from subdistrict to subdistrict, and from union to half-union and non-union fields. Mr. Lubin has made his way into this tangle of rates, and into the equally tangled theories that underly it, and has emerged with a remarkably serviceable chart of the existing confusion.

The author's main concern is not with the problem most obviously suggested by his title, but rather with the various *differentials* among the wage rates within the industry and with their effect on its organization. The industry explains these differences with the shibboleth of "competitive equality," but the phrase covers two distinct and incompatible doctrines. "Competitive equality"—market style—"means access to the market for all operators, irrespective of variations in mining conditions." "Competitive equality"—earnings style—"means uniform minimum earnings for all miners, irrespective of focal conditions." The former interpretation means lower wages in pick than in machine mines, in thin seams than in thick seams, and lower wages also in mines that bear higher freight charges. This has, on the whole, been the theory of the operators, and the other that of the miners—except in the case of the machine differential; but "on occasion each side has adopted the interpretation of the other," and the actual rate structure represents an extraordinary mixture of the two. What, then, of the effects? Wherever, answers Mr. Lubin, the theory of competitive equality—market style—has been put into effect, "it makes possible the operation of mines which have no economic justification"; and, although the rates set for machine mining at least have had less influence than is often supposed, the differentials based on this theory "are indirectly a cause"—though by no means the only

one—"for the overexpansion that today characterizes the bitumious industry."

This candid study of collective bargaining offers a stimulating challenge to those of us who rest great hopes on the extension of the practice. The authors of *The Control of Wages*, for example, advocate arrangements that will give to the workers as such a direct share in the gains of improved technique.[1] In the coal industry the union contracts contain a provision intended for that very purpose. Yet Mr. Lubin's arguments suggest that this particular device carries with it a definite danger to the long-run interests of the miners themselves. Other theorists—men as diverse as a Cambridge economist[2] and an American "new unionist"[3]—have made the point that the body of workers in an industry are more concerned with its regular operation than the individual employer, and that the extension of their control may tend toward the stabilization of industry. Yet the record which Mr. Lubin cites shows how strongly the argument that "a lot of little mining towns . . . . would have to go out of existence" in any such movement must inevitably appeal to the democratic body that represents the townsmen of those towns. On both points, then, the study raises serious doubts. Those who plan for these ends must at least plan more far-sightedly than the miners have done.

CARTER GOODRICH

UNIVERSITY OF MICHIGAN

Foreign Credit Facilities in the United Kingdom. By LELAND REX ROBINSON, PH.D. New York: Columbia University, 1923. Pp. 229. $2.50.[4]

This paper sketches the post-war development and the 1922 status of English financial organization for foreign financing of a commercial and investment nature. After a pre-view in Part I of English financial organization and its tendencies toward centralization, the author outlines in Part II the history, functions, and major financial

[1] Especially pp. 84–85 and 151–52.

[2] D. H. Robertson, *The Control of Industry*, pp. 93–94, 158–59.

[3] Sidney Hillman, quoted in H. M. Kallen, *Education, the Machine, the Worker*, pp. 166–67.

[4] This paper is No. 2 of Volume CVIII of *Studies in History, Economics and Public Law* edited by the faculty of political science of Columbia University, New York. The paper is separately bound.

policies of the newer institutions for financing overseas, commercial transactions. He also describes the trend in foreign financing operations of the older commercial banking concerns and points to interrelations between the older and the more recent institutions. He points out limitations on further expansion of foreign financing activities in England, and states that the United States must take the lead in new development.

The balance of the paper, Part III, is a study of English foreign investment trusts and of the foreign finance company as distinct from the trust. The economic basis and history of trust development is discussed. The financial policies, earnings distribution, accounting, and taxation problems of leading English trusts are considered in some detail. The problems facing development of similar organizations in the United States are indicated. There are five appendixes containing quantitative evidence to supplement and support the text material. The appendixes should be useful in selecting sources of information for further study in the fields of banking and investment.

Besides being well written and cogently reasoned, the paper offers numerous hints to American bankers, financiers, and students of finance. The English experience (presented in Part III) on investment distribution, earnings administration, and capitalization standards of investment trusts is valuable in a very practical sense. In the story of English banking centralization (told in Part I), students of banking theory will find food for thought on such problems as branch banking.

S. P. MEECH

UNIVERSITY OF CHICAGO

Lectures on the Principles of Money, Banking, and Foreign Exchange and their application to Australia. By R. C. MILLS AND F. C. BENHAM. Sydney: Published by the Authors, 1925. Pp. 135.

This book consists of a series of ten lectures, five by Mr. Mills and five by Mr. Benham, delivered at the Commonwealth Bank, Sydney, under the auspices of the Sydney University Extension Board.

Beginning with the nature and functions of money, the first three lectures cover the effects of changes in the price levels, the gold standard, the abandonment of the gold standard in England and Australia,

inconvertible paper and its effects on foreign exchange. Four lectures are devoted to banking theory in its various aspects and its relation to Australian banking in particular. Two lectures are given to a discussion of foreign exchange theory and practice, especially as between England and Australia. The last lecture is concerned with the future monetary policy of Australia, whether to stabilize the price level at the cost of a fluctuating exchange, or to stabilize the English exchange with a probably changing price level. The same problem faced South Africa where the commissioners gave considerable discussion to the matter and recommended a return to the gold standard rather than tying up with the English paper pound. For Australia, with its proportionately large trade with England, the authors apparently feel that a stabilized English exchange is to be preferred, however this opinion is advanced but tentatively. Now that England has resumed specie payments the problem is largely solved.

Although slightly marred in two places by misprints, the book is very carefully written in a pleasing manner, the exposition being very clear. It is probably over simplified but this is to be expected in light of its origin. As the title indicates, the problems discussed are Australian and of particular interest to Australians; however it is of general interest as it throws light on a monetary and banking system probably little understood in this country.

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The PRESS IMPRINT

For October and *November 1925*

The Panchatantra and the Critics

Arthur W. Ryder's translation of *The Panchatantra* from the Sanskrit presents to American readers for the first time a world-classic akin to the "Arabian Nights," a collection over fifteen hundred years old of some of the best tales that have ever been written. Now, less than two months after publication, the first printing is exhausted, and the book is taking a leading place in the reviewers' columns. Here is how an ancient Eastern masterpiece appears to modern occidental critics:

Harry Hansen, writing in the *Chicago Daily News* under the title "Discretion in Sanskrit" says: "It seems to have been concocted by an ancient people who loved life, who lived with gusto, who profited by their experiences and who knew as much about living 2,000 years before modern plumbing as we do now. Arthur W. Ryder who has translated the whole of *The Panchatantra* for the first time—bits have been done before—evidently believes in the English language as a living tongue, just as Carl Sandburg believes in it. Consequently the book lacks that "literary" tone that would frighten off the younger generation. It seems singularly modern, considering that it was written before Christ."

Under "The Editor Recommends" *The Bookman* offers the following comment: "A series of remarkable and ancient stories which will appeal to any lover of the folk-ways of mankind. You have but to read these charming fables to learn all about life, and how it should be lived to the greatest advantage and with the least pain. . . . . Mr. Ryder's prose is fine. His translations approved in high quarters are doubtless fine too. . . . . "

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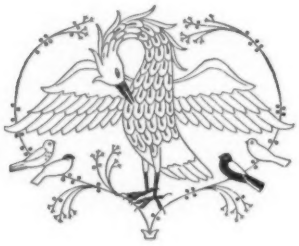

smaller volume, under the title of one of the stories, *Gold's Gloom*. Herschell Brickell, of the *New York Evening Post*, says of these two volumes of tales, "*The Panchatantra* is the sort of source-book no good library—not even an apartment-sized library—can be without; it is a volume as full of sheer story-interest as one could imagine, and at the same time amazingly rich in ripe and seasoned wisdom—old wisdom, which is ever new, as fresh and as useful today as when it was evolved out of life in the ancient East. In fact, its freshness is its most striking quality. *Gold's Gloom*, which contains a selection of tales from the larger book, is an attractive small volume of which only 2,000 copies have been printed. It is intended chiefly as a gift book. Mr. Ryder has performed a real service in giving this fine translation to American readers." *GOLD'S GLOOM, Tales from the Panchatantra*. Translated by ARTHUR W. RYDER. *$2.00, postpaid $2.10.*

Things Seen and Heard

Things Seen and Heard is the new volume of essays by Mr. Edgar J. Goodspeed, famous translator of the New Testament. In his opening essay, giving the theme that runs through much of his writing, Mr. Goodspeed says: "Reflection has satisfied me that much confusion of the modern mind is due to the incongruity of what we hear and what we see. . . . . You look about upon a community of earnest, hard-working people, soberly doing their daily work at business and at home. But you pick up the home edition and read of a very different world of violence and vice. All its men are scoundrels and its women quite different from those you see, to say the least. You have long been assured that this is the Age of Reason; but observation finds little to support the claim. The Age of Impulse would seem as good a guess. . . . . You read much lamentation over the sensationalism of the press, but as you read it, it is its conventionality that oftener leaves you mourning. . . . . The most disturbing thing is not that things seen and things heard contradict each other: that we might learn to allow for. The great trouble is that they seem to bear no relation to each other at all. . . . . "

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sees the world as a place not simply of facts and reality, but of something more interesting and intricate, in which "persons are as important as things, and feelings as facts."

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* * *

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He explains the famous "balanced-droplet" or "oil-drop" method by which he eliminated the uncertainties of preceding work on *e*, and furnished unimpeachable proof of the granular structure of electricity. The book presents, too, a correct and just view of earlier electrical theories and earlier attempts at the determination of *e* from Franklin down to H. A. Wilson. It describes the structure of the atom, and explains how Professor Millikan and other scientists were able to see with the eyes of the mind not only into the atom but also into its nucleus, and to count just how many positive and how many negative electrons are there imprisoned. *THE ELECTRON: Its Isolation and Measurement and the Determination of Some of Its Properties.* By ROBERT A. MILLIKAN. *$2.00, postpaid $2.10.*

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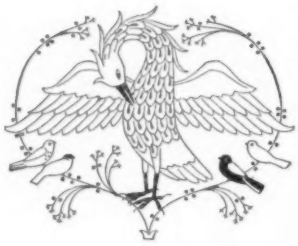

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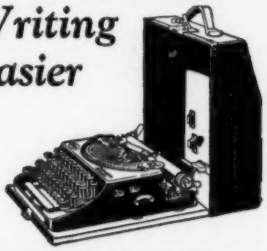

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